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PESTICIDES ABSTRACTS

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Quarterly Index Issue

U.S. ENVIRONMENTAL PROTECTION AGENCY

U.S. ENVIRONMENTAL PROTECTION AGENCY
OFFICE OF PESTICIDES AND TOXIC SUBSTANCES
Management Support Division
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PESTICIDES ABSTRACTS (formerly Health Aspects of Pesticides Abstract Bulletin) is a monthly publication of the Management Support Division of the Office of Pesticides and Toxic Substances, Environmental Protection Agency.

The purpose of this publication is to foster current awareness of the major worldwide literature pertaining to the effects of pesticides as defined in the Table of Contents. The publication represents a monthly review of more than 2,000 primary and secondary sources. A list of periodicals from which articles have been abstracted appears annually in the January issue. Subjects and authors of abstracted articles are cross-referenced in quarterly and annual indexes. Reprint requests should be directed to the author of the complete article.

Publication of an abstract, annotation, or citation does not imply endorsement by the Environmental Protection Agency of the original article or of commercial materials, equipment, or processes mentioned therein.

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NOTICE TO SUBSCRIBERS

WE REGRET TO INFORM YOU THAT, DUE TO BUDGET RESTRICTIONS, THE ENVIRONMENTAL PROTECTION AGENCY WILL NO LONGER PUBLISH THE PESTICIDES ABSTRACT BULLETIN. THE FINAL PUBLICATION WILL BE THE DECEMBER ISSUE, FOLLOWED BY THE 1981 ANNUAL INDEX.

THE STAFF OF THE EPA, OFFICE OF PESTICIDES AND TOXIC SUBSTANCES, AND THE FRANKLIN INSTITUTE HAVE ENJOYED THE PRIVILEGE OF PREPARING THIS PUBLICATION FOR THE PESTICIDES SCIENTIFIC COMMUNITY.

81-2401. Davies, A. G.; Smith, P. J. (Chem. Dep., Univ. Coll. London, London, England) **Recent advances in organotin chemistry.** *Adv. Inorg. Chem. Radiochem.* 23: 1-77; 1980 (566 references).

Recent advances in organotin chemistry are reviewed. Major topics include preparation and reactions, structural chemistry, biological and environmental aspects, and industrial applications. Four principal methods of forming the tin-carbon bond are described, including direct synthesis from metallic tin, from organic derivatives of more electropositive metals, from tin-lithium and tin-sodium compounds, and by hydrostannation of an alkene or alkyne. Formation of tin-hydrogen, tin-oxygen, tin-nitrogen, tin-sulfur, and tin-tin bonds is also reviewed. Functionally substituted compounds and bonding of tin with other metals is discussed. Tin radicals ($R_3Sn\cdot$) and stannylenes (R_2Sn), important intermediate compounds, are described. X-ray and ^{119}Sn Mossbauer spectroscopy investigations of the stereochemistry of organotin compounds are reviewed. Organotin compounds have application in agriculture as pesticides: biological activity, mode of toxic action, and environmental degradation are discussed. Biological uses of R_3SnX compounds and non-biological uses of R_2SnX_2 and $RSnX_3$ compounds are summarized.

81-2402. Mayer, P.; Kriemler, H. P.; Hambock, H.; Laanio, T. L. (Agric. Div., Ciba-Geigy Ltd., CH-4002 Basel, Switzerland) **Metabolism of *O,O*-dipropyl *S*-(2,(2′-methyl-1′-piperidinyl)-2-oxoethyl) phosphorodithioate (C 19 490) in paddy rice.** *Agric. Biol. Chem.* 45(2): 355-360; 1981 (5 references).

The fate of *O,O*-dipropyl *S*-[2,(2′-methyl-1′-piperidinyl)-2-oxo-ethyl] phosphorodithioate (C 19 490, piperophos) was followed in greenhouse-grown rice after application of 1.6 kg/ha ^{14}C-labeled C 19 490 into the paddy water. At maturity the shoots contained 2.5 ppm and the hulled grains 0.16 ppm ^{14}C-C 19 490 equivalents. Small amounts of unchanged C 19 490 were found in the shoots but none in the grains. The main metabolites found were 2-(2′-methyl-1′-piperidinyl)-2-oxo-ethane sulfonic acid, 2-(2′-methyl-1′-piperidinyl)-2-oxo-ethanoic acid and a fraction of polar unknown substances. *O,O*-Dipropyl *S*-[2-(2′-methyl-1′-piperidinyl)-2-oxo-ethyl] phosphorothioate, 2-(2′-methyl-1′-piperidinyl)-1-methyl-sulfinyl-2-oxo-ethane, 2-(2′-methyl-1′-piperidinyl)-1-methyl-sulfonyl-2-oxo-ethane, 2-methyl-piperidine and CO_2 were found in smaller amounts. (Author abstract by permission)

81-2403. Mayer, P.; Kriemler, H. P.; Laanio, T. L. (Agric. Div., Ciba-Geigy Ltd., CH-4002 Basle, Switzerland) **Metabolism of *N*-(1′,2′-dimethylpropyl) -*N*′-ethyl-6-methylthio-1,3,5-triazine-2,4-dimine (C 18898) in paddy rice.** *Agric. Biol. Chem.* 45(2): 361-368; 1981 (6 references).

The fate of C 18 898 [Dimethametryn; *N*-(1′,2′-dimethylpropyl)-*N*′-ethyl-6-methylthio-1,3,5-triazine-2,4-diamine; I] was followed in greenhouse-grown rice after application of 0.4 kg/ha of ring-^{14}C-labeled herbicide into the paddy water. At maturity leaves contained 1.37 ppm and hulled grains contained 0.088 ppm of ^{14}C-C 18 898 equivalents. The following degradation products were isolated from the plant: *N*-(1′,2′-dimethylpropyl)-6-methylthio-1,3,5-triazine-2,4-diamine (II), *N*(1′,2′-dimethyl-2′-hydroxypropyl)-*N*′-ethyl-6-methylthio-1,3,5-triazine-2,4-diamine (III), *N*-(1′,2′-dimethyl-3′-hydroxypropyl)-*N*′-ethyl-6-methylthio-1,3,5-triazine-2,4-diamine (IV), *N*-(1′,2′-dimethylpropyl)-*N*′-ethyl-1,3,5-triazine-2,4,6-triamine (V), *N*-(1′,2′-dimethylpropyl)-1,3,5-triazine-2,4,6-triamine (VI), *N*-(1′,2′-dimethylpropyl)-*N*′-ethyl-6-hydroxy-1,3,5-triazine-2,4-diamine (VII), and *N*-(1′,2′-dimethylpropyl)-6-hydroxy-1,3,5-triazine-2,4-diamine (VIII). Some polar transformation products were characterized as amino acid conjugates. Products isolated from the soil were: (I), (II), (III), (IV), 6-hydroxy-analogues of (III) and (IV), (VII), (VIII), and *N*-(1′,2′-dimethylpropyl)-*N*′-ethyl-6-methylsulfinyl-1,3,5-triazine-2,4-diamine (IX). (Author abstract by permission)

81-2404. Chakraborti, S.; Banerjee, S. K.; Chatterjee, G. C. (Physiol. Res. Cell, Darjeeling, West Bengal, India) **The effect of malathion on amino acid incorporation into plasma membrane proteins of *Vigna sinensis* (L): effect of plant growth hormone supplementation.** *Agric. Biol. Chem.* 45(2): 385-391; 1981 (34 references).

Amino acid incorporation into plasma membrane proteins of *Vigna sinensis* (L) was inhibited by malathion, an organophosphorus insecticide, whereas some stimulatory effect was elicited by plant growth hormones, *viz.*, IAA, GA_3 and kinetin. The inhibitory effect of malathion towards amino acid incorporation into plasma membrane proteins was marked at concentrations above 50 ppm, and at 400 ppm the amino acid incorporation was much less. Up to 100 ppm of malathion treatment, the plant growth hormones could counteract the malathion-induced inhibition on amino acid incorporation into plasma membrane protein but above this concentration the plant hormones gradually lost their effectiveness. Plasma membrane fraction was characterized by studying the activities of enzymes like IDPase, Oligomycin-treated ATPase, Cytochrome *c*-oxidase and glucan synthetase, and also by a sterol/phospholipid ratio study. From the above studies it appears that glucan synthetase may be the marker enzyme of the plasma membrane of *V. sinensis* (L), and some change at the membrane level on malathion exposure is suggested. (Author abstract by permission)

81-2405. Zemskaya, V. A.; Rakitin, Iu. V.; Chernikova, L. M.; Kalibernaia, Z. V. (Inst. Plant Physiol., Moscow,

USSR) O deistvii 2,4-D na rasteniya ovsa. [Effect of 2,4-D on oat plants.] *Agrokhimiya* (4): 106-111; 1981 (19 references) (Russian).

The results of experiments on the effect of the herbicide 2,4-D on the growth and development of oat plants are reported. Treatment of plants with 2,4-D at rates corresponding to 1 and 2 kg/ha inhibited growth and decreased yield. Monitoring of the formation of the leaves showed significant decrease of the total leaf surface forming after treatment with 2,4-D. Treatment with 2,4-D also caused inhibition of stem growth and accumulation of the dry substance in the aerial parts of oat plants. Special experiments with treatment of plants at tillering phase with labeled 2,4-D showed that the mechanism of the inhibitory effect was associated with translocation of herbicide from the leaves into the apical cone.

81-2406. Semenov, V. D.; Savkina, E. A. (Agric. Inst., Velikie Luki, USSR) Vliyanie miogoletnego sistematicheskogo primeneniya kombinirovannykh gerbitsidov na fitotsenoz i mikrofloru pochvy v bessmennykh posevakh yarovoi pshenitsy. [Effect of repeated systematic use of combined herbicides on phytocenosis and soil microflora in spring wheat crop.] *Agrokhimiya* (4): 112-117; 1981 (16 references) (Russian).

The effect of repeated systematic application of combined herbicides diamet-D (MCPA), dialen, and 2,4-D on the plant community and soil microflora was studied in spring wheat crops. Systematic (6 yr) use of herbicides controlled weeds, but increased the number of resistant weed species. Herbicide application did not change the soil microflora. The count of soil fungi and actinomyces after 7 yr application was similar to that in control.

81-2407. Loi, N. P. (All-Union Res. Inst. Chem. Means Plant Prot., Moscow, USSR) Fitotoksichnost' gerbitsidov – proizvodnykh benzimidazola v sravnenii so spetsificheskimi metabolicheskimi ingibitorami i narkotikami. [Comparative phytotoxicity of benzimidazol herbicides, specific metabolic inhibitors and narcotics.] *Agrokhimiya* (4): 118-122; 1981 (12 references) (Russian).

The toxicity of benzimidazol herbicides (1-isopropenyl- 5-chloro-benzimidazol and 2-methyl-5-chlorobenzimidazol) to wheat shoots was compared with the toxicity of antibiotics (specific metabolic inhibitors) and narcotics. Herbicides inhibited the growth of wheat roots. The effects was similar to that of actinomycin D.

81-2408. Zwieg, G., ed.; Sherma, J., ed.* (Chem. Dep., Lafayette Coll., Easton, PA 18042) Analytical methods for pesticides and plant growth regulators. Updated general techniques and additional pesticides. *(Academic Press: NY):* 11: 408 pp.; 1980.

This book reviews updated general techniques for pesticide and plant growth regulator analyses, and introduces methods for additional pesticides not included in earlier volumes. Discussions are given concerning the use of automated methods, high performance liquid chromatography, and quantitative thin layer chromatography. Specific pesticides and acaricides discussed include etrimfos, promacyl, quinalphos, terbufos, and thiocyclam-hydrogenoxalate. Fungicides discussed include ethylenebisthiocarbamates and their degradation products, fentin hydroxide, iprodione, and tricyclazole. Herbicides and plant growth regulators discussed include chlorpropham, difenzoquat, Drepamon, flurecol, oxyfluorfen, quintex, and tebuthiuron. The analysis of N-nitroso compounds in pesticide formulations is also described. Abstracts of chapters from this book will appear in the appropriate sections of this issue of *Pesticides Abstracts.*

81-2409. Dabydeen, S.; Leavitt, J. R. C. (Dep. Agron., Univ. Nebraska Lincoln, Lincoln, NB 68583) Absorption and effect of simazine and atrazine on *Elodea canadensis. Bull. Environ. Contam. Toxicol.* 26(3): 318-385; 1981 (6 references).

Branches of *Elodea canadensis* were placed in beakers containing atrazine or simazine solutions. The first observable effect of simazine at 3 ppm was a cessation of cyclosis and plasmolysis of the cell. At both the 3- and 5-ppm levels of simazine, chloroplasts migrated toward the center of the cells until they were aggregated, chlorophyll began to leak into the cytoplasm, and the chloroplasts died. Atrazine caused the same symptoms, but they developed at a slower rate. The effects at 48 hr with atrazine were equivalent to the 24-hr simazine treatment. It was concluded that simazine is absorbed more slowly, but proves to be more toxic to *Elodea.* The most striking effect of both herbicides on *Elodea* was the migration of the chloroplasts to the center of the cell, their aggregation, loss of pigment, and death.

81-2410. Smirnoff, W. A. (Laurentian For. Res. Cent., Ste. Foy, Quebec, Canada) Technological requirements for a successful *Bacillus thuringiensis* application against spruce budworm. *Can. For. Serv. Bi-mo. Res. Notes* 36(6): 29-30; 1980.

Two formulations of *Bacillus thuringiensis (B.t.),* which have proved to be successful over the past 6 yr using the boom-and-nozzle spray system, are noted. One formulation was 8.4 BIU/l, *B.t.* concentrate, 50 parts; sorbitol 70% solution, 20 parts; water, 30 parts; chitinase, 10,000 nephelometric units/ha; Chevron sticker, 3 ml/ha. The second formulation was 8.4 BIU/l concentrate, 50 parts; 30% solution of NaH_2PO_4, 50 parts; chitinase, 10,000 nephelometric units/ha; Chevron sticker, 3 ml/ha. When the technological *B.t.* requirements, spray system, and formulations were respected, the results for spruce

budworm mortality and foliage protection were satisfactory and uniform, ensuring high foliage protection and tree improvement.

81-2411. Smirnoff, W. A. (Laurentian For. Res. Cent., Ste. Foy, Quebec, Canada) **Calibration tests with various *Bacillus thuringiensis* preparations.** *Can. For. Serv. Bi-mo. Res. Notes* 36(6): 30-31; 1980.

Calibration tests with formulations of *Bacillus thuringiensis (B.t.)* in operation against *Choristoneura fumiferana* (Clem.). Two sample sites were chosen, one a forested area and the other an open area. Both sites were used to measure deposits and swath widths. The forested area represented conditions usually met during operational spraying against spruce budworm. The results indicated that concentrated and compact formulations such as 32B/sorbitol/water and 32B/NaH_2PO_4 at 30% (19.8 BIU/ha, 4.7 l/ha,) were easily handled and had a proper dispersibility index with a deposit meeting the precited criteria. Swath width, with the required number of droplets, was 160 m for 3 aircraft flights, 33 m apart. An adjuvant is seen as essential to the *B.t.* formulations to ensure sufficient deposit. Use of thuricide 16B was not profitable, its physical properties made it necessary to disperse twice as much final volume/ha to obtain the required dosage. Deposit assessments carried out by enumeration of *B.t.* colonies growing on nutrient agar medium exposed to spray, and the use of millipore filtering membranes, were insufficient. Dispersion with the ultraconcentrated formulations was satisfactory, meeting the criteria for swath width of more than 110 m. Droplets were very dense and contained a concentrated dose of *B.t.*

81-2412. Dagani, R. (Chem. & Eng. News, Washington, DC) **Seveso: five years later, questions remain.** *Chem. Eng. News* 59(26): 18-20; 1981.

Five years after the explosion at Seveso, Italy, the future of the inhabitants and the land remains as uncertain as ever. No human deaths have been directly attributed to the accident. Acute effects of TCDD exposure have been surprisingly mild. However, long-term effects have yet to be understood. The compound TCDD persists in the environment because it is chemically inert and not readily broken down by microbial degradation. TCDD is, however, disappearing from the topsoil in the area. This may be due to photodegradation. But below the surface, the toxin persists with a 10-yr half-life. Uncertain connections between TCDD and cancer are being explored. Monitoring of persons around Seveso has yielded only incomplete and inconclusive epidemiological data.

81-2413. Anonymous **DDT, anyone?** *Chem. Mark. Rep.* 219(16): 7, 35; 1981.

The Department of Defense is making plans to dispose of huge stocks of liquid, powdered, and aerosol forms of DDT with Defense Property Disposal Service (DPDS). DPDS has conducted consultations with the US EPA and 45 public interest groups and drawn up a 500-page impact statement on the feasible methods of disposal of the DDT by commercial contract. Public hearings were conducted on the subject of the disposal from July through September 1980. Although no federal standards exist for the incineration of DDT, this route will be the preferred method of disposal. Meanwhile, until plans are completed, costs to safely store and repackage this hazardous pesticide continue to mount each year.

81-2414. Khotyleva, L. V.; Deeva, V. P.; Shevelukha, T. A.; Badulina, E. I.; Sheleg, Z. I.; Stal'makova, R. N. (Inst. Genet. & Cytol., Minsk, USSR) **Geneticheskii kontrol' ustoichivosti rastenii pshenitsy k vozdeistviyu 2,4-D. [Genetic control of resistance of wheat plants to 2,4-D.]** *Dokl. Akad. Nauk BSSR* 25(4): 366-368; 1981 (10 references) (Russian).

Genetic control of resistance to the herbicide 2,4-D was studied in wheat. A wide spectrum of ditelocentric (DT) lines were sprayed with amine salt of 2,4-D ($10^{-2}M$) during the tillering phase. The growth, development, and productivity of wheat plants were monitored throughout the entire vegetative period. Euploid lines were used as control. Treatment with 2,4-D resulted in significant inhibition of wheat plants and decrease of grain weight. Karyologic analysis showed that sensitivity to 2,4-D was associated with the absence of the short chromosome arm.

81-2415. Shvetsov, S. G.; Gamburg, K. Z. (Siberian Inst. Plant Physiol. Biochem., Irkutsk, USSR) **Postuplenie 2,4-D v kletki kukuruzy v suspenzionnoi kul'ture. [Penetration of 2,4-D into corn cells in suspension culture.]** *Dokl. Akad. Nauk SSSR* 257(3): 765-768; 1981 (8 references) (Russian).

The effect of culture medium and the conditions of culturing on the penetration of 2,4-D into corn cells was studied. Suspensions of corn cells were incubated with labeled 2,4-D (0.1 mg/l). Absorption of 2,4-D and the intracellular level of 2,4-D under steady-state conditions depended upon the density and age of the culture. The relationship between the rate of 2,4-D penetration into cells and its concentration in the medium can not be explained in terms of passive diffusion.

81-2416. Dryanovska, O. A.; Petkov, S. T. (Inst. Genet., Bulg. Acad. Sci., Sofia, Bulgaria) **Cytogenetic after-effect of herbicides Igran and Sencor on *Pisum sativum* L.** *Dokl. Bolg. Akad. Nauk* 33(11): 1549-1552; 1980 (11 references).

Sown seed for Uladovsky 303 field fodder peas were sprayed with Igran (terbutryne; 300 and 400 g in 30 *l* water/decare) and with Sencor (metribuzin, 50 g in 30 *l* water/decare). Higher mitotic indices were noted in plants treated with the herbicides than in non-treated controls. Studies of chromosome aberrations indicate that the percentage of aberrations among herbicide-treated plants was higher than in control plants. Sencor induced fewer aberrations than Igran. Higher doses of Igran caused a higher percentage of bridges and lagging chromosomes than a weaker dose. The highest Igran dose had a greater effect on cell division and caused the higher total percentage of chromosome aberrations (translocations and lagging chromosomes).

81-2417. Warren, J. (Nat. Resour. Def. Counc., New York, NY) **Law. PCBs: a status report.** *Environment* 23(4): 2-4; 1981 (1 reference).

Progress in protection of the public against PCB exposure is discussed. In November 1975 petitions were brought to the FDA to lower the limits of tolerance for PCBs in freshwater fish from 5 ppm. However, the FDA did not act on the petitions until April 1977. In 1976 Congress established a 2.5-yr period for the general elimination of PCBs from commercial production and use, with limited exceptions. In 1977 the EPA lowered the effluent standard for PCBs to zero discharge. Within 1 mo after the final PCB ban regulations were published, a major PCB contamination incident occurred in a plant producing animal feed in Billings Montana due to a leaking PCB transformer. Many lots of feed leaving the plant were contaminated; the contamination spread to food and feed in 19 states and 2 foreign countries before it was checked by the FDA and USDA.

81-2418. Metcalf, R. L.; Kelman, A. (Dep. Zool., Univ. Illinois, Urbana, IL) **Integrated pest management in China.** *Environment* 23(4): 6-13; 1981 (23 references).

Integrated pest management (IPM) in China is discussed. Techniques have included the use of fire for locust control and planting crops not attractive to locusts, such as legumes. Biological controls currently used include the release of hymenopterous parasitoids (*Trichogramma* and *Anastatus*) and coleopterous predators (*Coccinella septempunctata*); microbial control with *Bacillus thuringiensis* and *Beauveria bassiana*; and the use young ducklings as insect predators in rice fields. A single duckling has been found to consume about 200 insects/hr. Herding of ducklings through 3900 ha of early rice crop in Guangdong province reduced the pest population 65-70%. Chemical insecticide use is also discussed. Following World War II organochlorine insecticides were widely used. However, in the early 1950s production of cyclodiene insecticides in China was halted. By 1975 the use of DDT and BHC was being rapidly phased out. Currently, organophosphorus compounds are the basic insecticides used in China; trichlorfon is the insecticide produced on the largest scale. Ecological issues, including the development of resistance, the emergence of secondary pests, and adverse effects of intensive pesticide use on human health and environmental quality, are also discussed.

81-2419. El-Sebae, A. H.; Soliman, S. A.; El-Bakary, A. S.; Kadous, E. A. (Plant Prot. Dep., Coll. Agric., Alexandria Univ., Alexandria, Egypt) **The role of wheat ATPase and diamine oxidase in phytotoxicity of substituted phthalimides.** *Int. Pest Control* 23(2): 51-54; 1981 (22 references).

Cotton seedlings were used in phytotoxicity screening of phthalimide and 15 N-substituted derivatives. The seedlings were severely injured. To determine the target of this phytotoxicity, ATPase isolated from wheat seedling roots was incubated with the phthalimides. Most of the phthalimides had no significant inhibitory effect on ATPase activity. Further studies in which diamine oxidase (DAO) isolated from wheat root tissues was incubated with the herbicides produced a good correlation between phytotoxic injury and degree of DAO inhibition. Since it is known that amine oxidases are involved in the biosynthesis of the plant hormone indoleacetate, it is suggested that these DAO inhibitors act by affecting plant growth regulation.

81-2420. Bowonder, B. (Cent. Sci. Policy & Manage. Res., Adm. Staff Coll., Hyderabad, 500475, India) **Issues in environmental risk assessment.** *J. Environ. Syst.* 10(4): 305-331; 1981 (134 references).

The assessment of environmental risks in developing countries is a new concept which is becoming increasingly important. Environmental risk may take the form of exposure to high levels of atmospheric CO_2, DDT in the food chain, the strains of urbanization and deforestation, and infections of bilharzia (schistosomiasis). Environmental risks are defined as interactive, irreversible, multiorder, and long term. The major factors in achieving impartial evaluations of environmental risks are considered and a six-step procedure is offered to reinforce the association of risk assessment and the policy system. A new behavioral world order is needed which would exist through the cooperative research of politicians, academia, planners, administrators, and environmentalists.

81-2421. Underwood, E. J. (Author address not given) **Trace metals in human and animal health.** *J. Hum. Nutr.* 35(1): 37-48; 1981 (30 references).

The role of trace metals, including iron, copper, zinc, manganese, molybdenum, and selenium, in human health and nutrition is discussed. The mode of action of

these trace metals is considered; the amounts present are very small, and they serve primarily as catalysts. Some results of trace element deficiencies are described; zinc deficiency is discussed in detail. Interactions of these trace elements in the human body are also discussed. The effects of continuous long-term exposure of man and animals to potentially toxic substances, especially lead, cadmium, and mercury, are considered. One source of lead is fungicides. There are many sources of cadmium in the biosphere, particularly industries involved in electroplating and manufacture of plastics, paints, and cadmium batteries. Sources of mercury include the burning of fossil fuels, the chlor-alkali industry, and the manufacture of electrical apparatus.

81-2422. Shipman, L. L. (Chem. Div., Argonne Natl. Lab., Argonne, IL 60439) **Theoretical study of the binding site and mode of action for photosystem II herbicides.** *J. Theor. Biol.* 90(1): 123-148; 1981 (80 references).

Available experimental data on the binding site and mode of action for photosystem (PS) II herbicides are discussed in light of herbicide binding-site models. This discussion reviews the analogy between the reducing sides of PS II from green plants and the PS from purple photosynthetic bacteria; proposed molecular mechanisms for PS II herbicide binding and mode-of-action; the molecular fragment floating spherical Gaussian orbital method; the molecular geometries for self-sufficient field calculations; and SCF results on uradil, guanidinium formate, and guanidinium bicarbonate. Other topics reviewed are the calculation of point charge arrays and their application to the computation of coulombic potentials and electrostatic interaction energies; the binding energies and equilibrium geometries for the uracil-guanidinium formate and uracil-guanidinium bicarbonate pi-pi complexes; and the implications of the present results for experimental studies of herbicide binding and electron transport in PS II.

81-2423. Deeva, V. P.; Dvoriankin, E. A. (V. F. Kuprevich Inst. Exp. Bot., Minsk, USSR) **Deistvie gerbitsidov na razlichnye po produktivnosti sorta sakharnoi sveklya. [Effect of herbicides on sugar beet varieties with different productivity.]** *Khim. Sel'sk. Khoz.* 19(4): 26-29; 1981 (6 references) (Russian).

The effect of the herbicides Eptam (EPTC), Betanal (phenmedipham), and sodium trichloroacetate (TCA) on the productivity of sugar beet was studied. The experiments were conducted in 3 varieties of sugar beet with different physiological parameters. Herbicides significantly decreased the intensity of photosynthesis (by 25 and 36% after application of Eptam and Betanal, respectively). The decrease was more pronounced in the the sugar-producing variety. TCA increased intensity of respiration in leaves and roots. This increase was also more pronounced in the sugar-producing variety of sugar beet.

81-2424. Sharma, C. B. S. R.; Patra, B.; Raju, D. S. S.; Murty, K. V. (Dep. Bot., Berghampur Univ., Berhampur 760007, India) **Chiasma variation in *Hordeum vulgare* after exposure to herbicides.** *Mutat. Res.* 91(4-5); 333-336; 1981 (16 references).

Three herbicides (bromacil, lenacil and terbacil) reduced chiasma frequencies in barley. The reduction was significant only with terbacil. The source of such variation is considered to occur fairly early during the development as the treatment with herbicides was carried out during the first synthesis (S) period of the seeds. The likely importance of the observations in experimental crop populations and in genetic toxicology is discussed. (Author abstract by permission)

81-2425. Hall, P.; Selinger, B.; Field, B.; Kerr, C. (Australian Natl. Univ., Canberra, Australia) **Antipodean 2,4,5-T.** *Nature (London)* 290(5801): 8; 1981 (6 references).

In a letter to the editor, the authors express concern that surplus supplies of the defoliant Agent Orange (2,4-D + 2,4,5-T) may have been imported to Australia in the late 1960s and early 1970s. Inquiries were begun in August of 1971 by the Australian government regarding the importation of salts of 2,4,5-trichlorophenol. A thorough investigation concerning the quantities of the chemicals which entered Australia is recommended. The results could significantly affect a multi-million dollar epidemiological study presently being undertaken by the Australian government on the effects of such defoliants on Vietnam veterans.

81-2426. Theofanous, T. G. (Sch. Nucl. Eng., Purdue Univ., West Lafayette, IN 47907) **A physicochemical mechanism for the ignition of the Seveso accident.** *Nature (London)* 291(5817): 640-642; 1981 (8 references).

The so-called Seveso explosion of 10 July 1976 was completely unexpected, and various speculations about its initiation have been entertained, including the possibility of sabotage. Seveso has remained the focus of undiminished interest and publicity and the puzzle concerning the occurrence of its accident persists. The explanation proposed here is based on our recent investigations of the relevant chemical kinetics and heat transfer phenomena. This physicochemical mechanism involves the combination of exothermic reactions starting (personal communication from the Givaudan Company) below the previously known 230°C threshold and a thermal conduction-convection-radiation process responsible for channelling the normally negligible (in global sense) upper reactor wall heat into a small portion (10%) of the reactor contents, thus yielding the temperature range conducive to these exothermic reactions. (Author abstract by permission)

81-2427. Tatsuyama, K.; Yamamoto, H.; Egawa, H. (Fac. Agr., Shimane Univ., Matsue, Shimane, Japan) **[Bioassay of dechlorination of benthiocarb (thiobencab)**

herbicide in flooded soil using germinated grains of rice plant.] *Nippon Noyaku Gakkaishi (J. Pestic. Sci.)* 6(2): 193-199; 1981 (11 references).

Factors that cause dwarfing in rice plants in paddies where benthiocarb was applied were studied. Germinated rice grains were cultivated in 2 g of soil containing 0.8% powdered raw wheat straw flooded with 3 ml of water for 1 wk; 2 ml aqueous benthiocarb was added to soil at 20 ppm of dry soil. In the treated soil, growth of the germinated rice grains was conspicuously inhibited after 3-7 wk. The addition of immature organic matter, such as raw wheat straw and starch, to the soil accelerated the dechlorination of benthiocarb and inhibited the degradation of the dechlorinated benthiocarb. The optimum temperature at which benthiocarb was dechlorinated in the soil was 20-25°C, and no growth inhibition of germinated rice grain was observed in the soil at 35°C. Degradation of dechlorinated benthiocarb proceeded faster at a higher temperature, and both formation and degradation of dechlorinated benthiocarb were not carried out in the sterilized soil. These findings suggest that the dwarfing of germinated rice grain may have been due to soil microorganisms.

81-2428. Kleudgen, H. K. (Bot. Inst., Plant Physiol., Univ. Karlsruhe, BRD) **Changes in composition of chlorophylls, carotenoids, and prenylquinones in green seedlings of *Hordeum* and *Raphanus* induced by the herbicide San 6706 – an effect possibly antagonistic to phytochrome action.** *Pestic. Biochem. Physiol.* 12(3): 231-238; 1979 (36 references).

Hordeum vulgare L. and *Raphanus sativus* L. were grown on a 10% Van der Crone nutrient solution containing San 6706, (metflurazon) 1 and 10 μmol/l at the time of sowing. The pigments in barley and radish seedlings were significantly inhibited by 1 μ*M* and to a higher degree by 10 μ*M* San 6706. The degree of inhibition of chlorophylls correlated with that of carotenoids in both plants. This pattern of inhibition points to a site of action which regulates the biosynthesis of all prenyllipids. The relative proportions of the single carotenoids induced by the herbicide change in different degrees. Zeaxanthin showed the highest increase and B-carotene the lowest in *Hordeum* and in *Raphanus*. The order of inhibition of enhancement of the carotenoids analyzed was similar to that in *Hordeum* and *Raphanus* seedlings (8.5 and 4.5 days old, respectively) kept in darkness and illuminated with white light (36 hr) but with an opposite sign. It is suggested that with respect to carotenoid synthesis, and perhaps also benzoquinone synthesis, San 6706 acts in man antagonistic way on the phytochrome reaction chain, possibly at the level of cytoplasmic ribosomes.

81-2429. Dell'Agnola, G.; Ferrari, G.; Nardi, S. (Inst. Agric. Chem., Univ. Padua, Padua, Italy) **Antidote action of humic substances on atrazine inhibition of sulfate in barley roots.** *Pestic. Biochem. Physiol.* 15(2): 101-104; 1981 (7 references).

Sulfate and leucine uptake by excised barley roots was evaluated. Uptake solutions were 50 ml of 1 m*M* Tris, 10 m*M* $CaCl_2$ containing 0.1 m*M* ^{35}S-labeled K_2SO_4 or 0.1 m*M* C^{14}-labeled leucine. The influence of atrazine and humus on the rate of sulfate uptake in barley roots was evaluated by addition of 1 or both substances to the uptake solution either at the beginning of the uptake period or after 16 hr incubation in the absence of sulfate with 1 or both substances. Humus slightly inhibited (20%) the sulfate uptake in the absence of incubation and strongly stimulated (80%) it after a 16 hr incubation period. Atrazine inhibition was 30%, even in the absence of an incubation period. The incubation increased the level of inhibition to 50%. Inhibition was not reduced when the incubation with atrazine was followed by an uptake period in a solution deprived of the inhibitor. The same happened for the stimulatory action of humic substances. It is concluded that humic substances, when present in the root environment prior to atrazine addition, can reduce some inhibitory side effects of the herbicide, such as the inhibition effect on the membrane transport of nutrients.

81-2430. Wilkinson, R. E. (Dep. Agron., Georgia Stn., Univ. Georgia, Experiment, GA 30212) **Production of thiobarbituric acid reactive products during photooxidation in S-ethyl dipropylthiocarbamate- treated wheat.** *Pestic. Biochem. Physiol.* 15(2): 149-157; 1981 (24 references).

Twenty-five wheat (*Triticum aestivum* L.) seeds were planted in each of 10 pots containing sand into which S-ethyl dipropylthiocarbamate (EPTC) had been evenly mixed at concentrations of 15.6, 31.25, 62.50, or 125.0 μg/kg. Average plant ht and fresh wt/pot decreased with increasing EPTC concentrations. Chlorophyll a, chlorophyll b, and total carotenoids increased significantly in plants treated with EPTC and grown under high-intensity light (270 μein/m^2/sec), but the quantities of these constituents were not significantly influenced by EPTC in plants grown under low-intensity light (20 μ/m^2/sec). Malonaldehyde formation in wheat leaves, which is dependent upon light intensity, was greatly reduced by the presence of EPTC unless the plants were grown under high-intensity light. In EPTC-treated plants grown under high-intensity light, formation of malonaldehyde correlated directly with linolenic acid content of the leaves; in those grown under low-intensity light, formation of malonaldehyde did not increase with linolenic acid content > 11 mg. This information suggests that the decreasing linolenic acid in EPTC-treated plants is the result of inhibition of synthesis rather than increased linolenic acid degradation.

81-2431. Franklin, E. J.; Knowles, C. O. (Dep. Entomol., Univ. Missouri, Columbia, MO 65211)

Metabolism of diflubenzuron by spider mites and bean plants. *Pestic. Sci.* 12(2): 133-141; 1981 (13 references).

The two-spotted spider mite *Tetranychus urticae* Koch absorbed and metabolized [^{14}C]diflubenzuron relatively slowly; < 10% of the total radiocarbon was detected in internal mite fractions during the 96-hr exposure period. The metabolites were tentatively identified by coincident chromatography with reference standards as 4-chlorophenylurea, 2,6-difluorobenzoic acid, 4′-chloroformanilide, 2,6-difluorobenzamide, and 2 compounds monohydroxylated in the chloroaniline moiety. Little absorption of diflubenzuron occurred when the chemical was applied topically to leaves of bean plants. However, translocation of radioactive material did occur when [^{14}C]diflubenzuron was injected into the stem. Although 84% of the radioactive material remained in the stems, the leaves contained 9% and the roots 0.2%. Radioactivity apparently moved acropetally, but exhibited very little or no basipetal movement. Injected diflubenzuron was metabolized by the bean plants; most material recovered from the stems was organosoluble (> 95%) and consisted largely of diflubenzuron, while less (≈15%) of the material recovered from the leaves was organosoluble. Major organosoluble metabolites from the leaves were the same as those isolated from mites.

81-2432. Roberts, T. R.; Wright, A. N. (Shell Res. Ltd., Sittingbourne Res. Cent., Sittingbourne, Kent ME9 8AG, England) **The metabolism of 3-phenoxybenzyl alcohol, a pyrethroid metabolite, in plants.** *Pestic. Sci.* 12(2): 161-169; 1981 (4 references).

Abscised cotton leaves were used to study the metabolism and conjugation of 3-phenoxybenzyl alcohol, which is a plant metabolite of permethrin and cypermethrin. Mature cotton leaves were treated by petiole uptake of 3-phenoxybenzyl alcohol in aqueous solution. A rapid formation of a compound identified as the glucosyl 3-phenoxybenzyl ether took place initially. Later, more polar compounds were formed and shown to be disaccharide conjugates of the alcohol with glucose and pentose sugars. Interconversion of the alcohol and its mono- and disaccharide conjugates occurred in cotton leaves. Evidence suggested that ready exchange of the glucose units on the conjugates with free glucose in the leaves occurs. No larger carbohydrate conjugates of 3-phenoxybenzyl alcohol were detected. The introduction of a pentose unit at the primary alcohol of the monosaccharide may interrupt the buildup of a longer sugar chain. However, the relevance of these short-term reactions to the longer-term metabolism of 3-phenoxybenzyl alcohol has yet to be demonstrated.

81-2433. Veerasekaran, P.; Kirkwood, R. C.; Parnell, E. W. (Dep. Biol., Strathclyde Univ., Glasgow, G1 1XW, Scotland) **Studies of the mechanism of action of asulam in plants. Part I: antagonistic interaction of asulam and 4-aminobenzoic acid.** *Pestic. Sci.* 12(3): 325-329; 1981 (13 references).

Studies have been carried out on the herbicidal action of asulam and sulphanilamide, alone or in association either with 4-aminobenzoic acid (4ABA) or 4,6-diamino-1-(3, 4-dichlorophenyl) -1,2-dihydro-2, 2-dimethyl-1,3, 5-triazin (DCDT). The soaking of wheat seeds (*Triticum estivum* L.) for 12 hr at 30°C in asulam and DCDT in a 10:1 ratio doubled the inhibition of root growth produced by soaking in asulam alone; the addition of 4ABA partially reversed the activity of asulam. Foliar applications of a mixture of asulam + DCDT (1.1 + 0.55 kg/ha) markedly increased the activity of asulam in susceptible wheat, wild oat (*Avena fatua* L.), tolerant flax (*Linum usitatissimum* L.), and in *Stellaria media* L. The activity of asulam at 1.1 kg/ha was reversed by 4ABA at 2.2 kg/ha by about 50% in wheat and wild oat, 82% in flax and 100% in *S. media.* The results indicate that asulam and sulphanilamide act by similar mechanisms in apparently inhibiting the biosynthesis of folic acid. (Author abstract by permission)

81-2434. Veerasekaran, P.; Kirkwood, R. C.; Parnell, E. W. (Dep. Biol., Strathclyde Univ., Glasgow G1 1XW, Scotland) **Studies of the mechanism of action of asulam in plants. Part II: effect of asulam on the biosynthesis of folic acid.** *Pestic. Sci.* 12(3): 330-338; 1981 (38 references).

The possible relationship between folate levels in plants and their tolerance to asulam has been examined. Plants with a high content of folates were relatively less susceptible to asulam. There was evidence of a depletion of the folates in the shoots of plants treated with asulam, either alone at 1.1 kg/ha or in combination with 4,6-diamino-1-(3, 4-dichlorophenyl) -1,2-dihydro-2, 2-dimethyl-1,3, 5-triazin (DCDT) at 1.1 kg/ha. In wheat shoot tips (*Triticum estivum* L.), asulam at 1.1 kg/ha reduced the levels of the N^5-methyl, N^{10}-formyl and N^5-formyl derivatives of 5,6,7,8-tetrahydrofolates, particularly when applied in combination with DCDT. Studies with cell-free extracts of wheat seedlings revealed that asulam inhibited the enzymic synthesis of 7,8-dihydropteroate in a manner similar to sulfanilamide inhibition. The biochemical site of action of asulam in plants is discussed. (Author abstract by permission)

81-2435. Murphy, T. M.; Imbrie, C. W. (Dep. Bot., Univ. California, Davis, CA 95616) **Induction and characterization of chlorate-resistant strains of *Rosa damascena* cultured cells.** *Plant Physiol.* 67(5): 910-916; 1981 (25 references).

When strains of *Rosa damascena* cultured cells were selected for sodium chlorate ($NaClO_3$) resistance, only a minor fraction lacked the ability to grow on medium containing nitrate as the sole nitrogen source, and probably lacked the ability to reduce sodium chlorate to sodium

chlorite. The major fraction retained the ability to grow on nitrate medium and possessed the ability to transform chlorate to toxic products. The sensitivity of the cultured cells to chlorate was measured by plating samples of suspensions in agar containing $NaClO_3$. The age of the cultures that were plated determined the sensitivity. The proportion of cells resistant to $NaClO_3$ was increased by treating the cell aggregates with UV light alone or in the presence of the photosensitizing agent, 4'-methoxymethyltrioxsalen (MOMT). The increase in resistant cells was low and required very specific doses of UV light. UV treatment was not sufficient to select $NaClO_2$-resistant cells over $NaClO_3$-sensitive cells. The data suggest that UV had induced mutations leading to chlorate resistance. About 15% of the resistant strains did not grow on medium containing nitrate as the sole nitrogen source. These strains lacked ability to reduce sodium chlorate to sodium chlorite. These findings support the theory that $NaClO_3$ toxicity depends on the activity of nitrate reductase. About 85% of the resistant strains grew on medium containing nitrate as the sole nitrogen source. These strains lost catalase activity after $NaClO_3$ treatment, suggesting they took up and reduced the $NaClO_3$.

81-2436. David, D. (Lab. Biol. Anim., Univ. Clermont-Ferrand, CNRS, F-63170, France) **Laboratory evaluation of repellent properties against birds of the synthetic pyrethroid decamethrin.** *Poult. Sci.* 60(6): 1149-1151; 1981 (7 references).

Both technical grade and commercial formulations of the insecticide decamethrin administered in feed has a generally repellent action upon quail, with strong individual variations. The excipient used in the commercial preparation has a similar effect on its own, probably due to its odor. Repellency diminishes after repeated exposure and even becomes reversed in the case of the purified pyrethroid, which attracts intoxicated quail. (Author abstract by permission)

81-2437. Mount, M. E.; Oehme, F. W. (Dep. Clin. Pathol., Sch. Vet. Med., Univ. California, Davis, CA 95616) **Carbaryl: a literature review.** *Residue Rev.* 77: 1-64; 1981 (311 references).

Acute toxic effects of carbaryl to invertebrates and vertebrates indicate susceptibility of oyster pests and of 150 agricultural pests. Fish are less susceptible to carbaryl than to organochlorine or organophosphate insecticides. Birds are highly resistant to acute toxicity while mammals are affected by acute dose levels. The biomass and number of nontarget invertebrates are temporarily affected following acute exposure and aquatic organisms are sensitive to acute and chronic exposures. Honey bees are sensitive to exposure and earthworms are susceptible to carbaryl poisoning. Subchronic/chronic effects are related to biophysiological and reproductive parameters. Enzyme changes of the liver microsomal fraction and other biochemical changes have been observed. Reproductive measures including infertility, fetotoxicity, teratogenesis, and mutagenesis have been reported in animals. A significant increase in cancer administration of carbaryl has been reported. Interactions of carbaryl with other xenobiotic compounds have been demonstrated. Degradation of carbaryl occurs by hydrolytic and oxidative pathways. In mammals, metabolites are rapidly excreted in urine and bile. Light, pH, and temperature play an important role in environmental degradation. Carbaryl is adsorbed onto bottom mud in aquatic environments and onto soil. Microorganisms are, in part, responsible for degradative processes under these conditions. Persistence of carbaryl in the environment varies from 1 to several wk. Analytical procedures for carbaryl are extensive and varied. The phenolic hydrolytic product of carbaryl, 1-naphthol, is commonly used for spectrophotometric and fluorometric determination and for GLC detection following derivatization. Direct or derivatized intact carbaryl determination has been performed with GLC and HPLC procedures. Thin-layer chromatography, with chromogenic methods, cholinesterase enzyme reactions, and fluorogenic procedures, has been used for isolation and identification of carbaryl. Other means of detection include polarography, IR, and NMR. (Author abstract by permission, abridged)

81-2438. Bezhanishvili, K. N.; Kakhniashvili, K. A.; Ugrekhelidze, D. S. (Author address not given) **Izmenenie kolichestvennogo sostanza pigmentov i gidrolaznoi aktivnosti khlorofillazy list'ev vinogradnoi lozy pod deistviem atrazina. [Changes of the quantitative composition and hydrolyzing activity of chlorophylase in grapevine leaves under the action of atrazine.]** *Soobshch. Akad. Nauk Gruz. SSR* 101(2): 449-452; 1981 (8 references) (Russian).

Grapevine leaves were used in studies designed to determine the effects of the herbicide atrazine at concentrations of 8, 10, and 16 kg/ha on the hydrolyzing activity of chlorophylase and on the pigment content of the leaves. Atrazine at 10-16 kg/ha resulted in a decrease in the amount of pigment and a strong activation of the enzyme chlorophylase. These changes tended to return to normal levels during the 2nd yr of atrazine treatment. It is suggested that these 2 effects can serve as sensitive indices in determining the optimal herbicide dosages in the vineyard.

81-2439. Special Pestic. Rev. Div., US EPA, Arlington, VA **Captan: position document 1.** *US NTIS PB Rep.* PB81-109,449: 44 pp.; 1980 (48 references).

The report is a preliminary risk assessment for captan. It gives a preliminary examination of its use, environmental residues, and health effects including toxicology data. Limited information is provided for exposure and extent of risk. Results of a literature search are provided. (Author abstract by permission)

81-2440. Sanchez Martin, M. J.; Sanchez Camazano, M. (Cent. Edafol. & Biol. Apl., Salamanca, Spain) **Interaccion de monocrotofos con montmorillonita. [Interaction of monocrotophos with montmorillonite.]** *Agrochimica* 24(5-6): 381-389; 1980 (8 references) (Spanish).

IR spectrometric analysis and X-ray diffraction patterns on the interaction of the pesticide monocrotophos with the silicate clay montmorillonite (bentonite) have shown that the pesticide penetrates the interlayer space of the silicate to form 2 complexes of different basal spacing. The hydration status and interlayer cations of the samples, the nature of the solvent, and pesticide concentration determine which type of complex will be formed. In the complex of 16.35 A, the molecules of monocrotophos must interact with the interlayer cations through the P—O and C—O double bond groups. In two-layer complexes, the molecules interact only through the P—O double bond group.

81-2441. Spiridonov, Yu. Ya.; Shestakov, V. G.; Matveev, Yu. M.; Shabanov, A. K. (All-Union Res. Inst. Phytopathol., Moscow, USSR) **Sorbtsiya gerbitsidov osnovnymi komponentami pochvy. Soobshenie 2. Issledovanie sorbtsii – desorbtsii piklorama fraktsiyami organicheskogo veshchestva pochvy. [Adsorption of herbicides by soil components. Communication 2. Adsorptin and desorption of picloram by fractions of organic substance in the soil.]** *Agrokhimiya* (3): 121-127; 1981 (17 references) (Russian).

The role of various humus factors in the process of picloram sorbtion was evaluated. Five different soil types were tested. The degree of sorption showed close correlation with carbon content of the soil. The high molecular weight fractions of the humus (humin, humic acid and fulvic acid) provided up to 74% of total picloram adsorbing soil activity. The findings that picloram adsorbing activity of soddy-podzolic soil was 3.2 times greater than that of meadow-boggy soil (while the humus content in the former was only 1.4 times greater than that in the latter) confirmed the role of humus composition in picloram sorbtion.

81-2442. Saito, I.; Oka, H.; Takahashi, H.; Uno, K. (Aichi Prefect. Inst. Public Health, Nagoya, Aichi, Japan) **[Determination of organophosphorus pesticide in hen egg and animal liver.]** *Aichi-Ken Eisei Kenkyusho (Rep. Aichi Prefect. Inst. Public Health)* 31: 19-23; 1981 (10 references) (Japanese).

Pesticide residues were isolated from acetonitrile and dichlorobenzene extracts of hen's egg and hen, swine, and cow liver by gel permeation chromatography, using a copolymer of styrene and divinylbenzene as the column material. The extract (2 ml 25% solution) was injected into the gel column (23 mm internal diameter, 50 cm high) and eluted by a 1:3 mixture of ethyl acetate and benzene. In a separate, manual procedure, the extract was mixed with 30% acetonic hexane and eluted. Both purified extracts were compared by gas chromatography using bovine liver fortified with organophosphorus pesticide. By gel permeation, recoveries of dichlorvos, diazinon, fenthion, malathion, fenitrothion, and EPN at 0.1 ppm from hen's egg were 96, 89, 75, 85, 90, and 87%, respectively. By gas chromatographies recoveries were 89, 86, 79, 83, 86 and 80%, respectively. The results with liver extracts were almost the same as the results with egg extract. The gel permeation chromatography method was found to be simpler and more economical in terms of time and solvent required. Phospholipids contained in hen's egg and all liver samples interfered with the gas chromatography of unpurified extracts.

81-2443. Butler, L. C.; Staiff, D. C.; Davis, J. E. (Health Eff. Res. Lab., Wenatchee Pestic. Res. Branch, US EPA, Wenatchee, WA 98801) **Methyl parathion persistence in soil following simulated spillage.** *Arch. Environ. Contam. Toxicol.* 10(4): 451-458; 1981 (8 references).

Simulated spillage of emulsifiable concentrate (EC) and microencapsulated formulations of methyl parathion on soil were studied. Persistence of residues from both formulations spilled as concentrates and as simulated drum rinses were followed for up to 45 mo. Spillage of encapsulated formulation resulted in the formulation of a solid cake-like deposit on the soil surface, which could be a particularly attractive hazard to small children. At 45 mo, soil residues had decreased by 64% for emulsifiable concentrate spills, and 68% for the soil beneath the microencapsulated cake. Residue in the cake itself only decreased by 31%. Soil residue levels from simulated drum rinses were essentially innocuous by 45 mo for the emulsifiable concentrate and by 1 yr for the microencapsulated material. The leaching of methyl parathion from the microencapsulated cake into soil and the relationship between available residue and wet weather were also investigated. (Author abstract by permission)

81-2444. Nigg, H. N.; Stamper, J. H. (Univ. Florida, Inst. Food & Agric. Sci., Agric. Res. & Educ. Cent., Lake Alfred, FL 33850) **Comparative disappearance of dioxathion, malathion, oxydemeton-methyl and dialifor from Florida citrus leaf and fruit surfaces.** *Arch. Environ. Contam. Toxicol.* 10(4): 497-504; 1981 (10 references).

Surface residue disappearance rates of dioxathion, malathion, oxydemeton-methyl, and dialifor were the same for fruit and leaves, and they increase with temperature. Disappearance rates were in the order of malathion ≥ oxydemeton-methyl > > dialifor ≥ dioxathion. Malaoxon was present in relatively constant amounts under dry, cool, clear conditions but was not detected under wet, hot, cloudy conditions. (Author abstract by permission)

81-2445. Mallipudi, N. M.; Fukuto, T. R. (Div. Toxicol. & Physiol., Dep. Entomol., Univ. California, Riverside, CA 92521) **Characterization of bound phenthoate residues in citrus.** *Arch. Environ. Contam. Toxicol.* 10(4): 505-510; 1981 (3 references).

The metabolism and fate of phenyl ring-labeled ^{14}C-phenthoate [*O,O*-dimethyl *S*-[α-(carboethoxy) benzyl] phosphorodithioate] was examined in the Valencia orange fruit with emphasis on the characterization of bound phenthoate residues in the fruit peel. The products recovered from the citrus fruit wash were unchanged phenthoate, phenthoate oxon, demethyl phenthoate, phenthoate acid, ethyl mandelate, and mandelic acid. The same products, with the exception of phenthoate oxon, were found in the acetone extract of the fruit peel. Enzymatic hydrolysis of the bound residue in the peel with β-glucosidase, followed by acidic and basic hydrolysis gave ethyl mandelate as the major product, followed by mandelic acid, demethyl phenthoate and phenthoate acid. Phenthoate was metabolized and conjugated in citrus fruits into detoxication products. (Author abstract by permission)

81-2446. Cowgill, U. M. (Dep. Biol. Sci., Univ. Pittsburgh, Pittsburgh, PA 15260) **The chemical composition of bananas. Market basket values, 1968-1980.** *Biol. Trace Elem. Res.* 3(1): 33-54; 1981 (78 references).

Bananas were purchased weekly over a 12-yr period from a local market. They were purchased green and took 3 days or so to begin to turn yellow. The bananas came from Ecuador, Colombia, Panama, Honduras, Guatemala, Jamaica, Haiti, the Canary Islands, and possibly several countries in Central Africa, to be resold in Pittsburgh, PA. Over the 12-yr period, 46 elements were detected in the fresh pulp. Small quantities of Be and Cd were detected. No significant change was noted in Hg and Pb content in the past 3 decades. Arsenic content declined from 1967 to 1978; since 1978 the As content has risen, possibly due to increased use of arsenic-containing insecticides.

81-2447. Pimentel, D.; Garnick, E.; Berkowitz, A.; Jacobson, S.; Napolitano, S.; Black, P.; Valdes-Cogliano, S.; Vinzant, B.; Hudes, E.; Littman, S. (Dep. Entomol., Coll. Agric. & Life Sci., Cornell Univ., Ithaca, NY 14853) **Environmental quality and natural biota.** *BioScience* 30(11): 750-755; 1980 (60 references).

Natural biota perform many functions necessary to forestry, agriculture and other segments of society. Numerous laws have been enacted to protect the natural environment. An effective environment policy should include the protection of all organisms vital to the total ecosystem. A survey is presented to highlight the relative importance of major species in the ecosystem and assess the impact of human interference in these natural groups. The biomass may be used to evaluate the relative impact a natural group may have in the ecosystem. The degradation of wastes generated by human activities is examined. Pesticides and other chemical pollutants are degraded in the natural environment by biological and physical means. The degradation of several pesticides including toxaphene, diazinon and other organophosphorus insecticides is discussed along with the cycling of air pollutants and atmospheric CO_2. The role of natural biota in pollution and nitrogen fixation is investigated and the importance of certain species in pest control, soil conservation and crop harvesting are examined. The available data suggest that many functions of natural biota are being seriously affected by human activities.

81-2448. Miyazaki, T.; Kaneko, S.; Horii, S.; Yamagishi, T. (Tokyo Metrop. Res. Lab. Public Health, Hyakunincho, Shinjuku-ku, Tokyo 160, Japan) **Identification of polyhalogenated anisoles and phenols in oysters collected from Tokyo Bay.** *Bull. Environ. Contam. Toxicol.* 26(5): 577-584; 1981 (17 references).

Samples of oysters *Crassostrea gigas* were analyzed by gas chromatography/mass spectroscopy (GC/MS) and found to contain a variety of polyhalogenated anisoles and phenols. Following collection from Tokyo Bay and shucking of the oysters, samples were homogenized and extracted with acetonitrile and hexane, and purified by multiple cleanup with a florisil column. The compounds in the oysters were tentatively identified as trichloro-, bromodichloro-, chlorodibromo-, 2,4,6-tribromo- and pentachloroanisole (PCA) as well as dichloro-, chlorodibromo-, trichloro-, dibromo-, tetrachloro- and tribromophenetole. The residues of these compounds ranged from 2 to 20 ppb. The presence of the halogenated phenetoles was taken to indicate the presence of the corresponding phenols. It is suggested that the tri- and tetrachlorophenol and anisole residues may be derived from PCP, its metabolites in fields, or impurities and intermediates of industrial and agricultural chemicals.

81-2449. Brevik, E. M. (Inst. Energy Technol., N-2007, Kjeller, Norway) **Organochlorine residues in fish from Lake Mjosa in Norway.** *Bull. Environ. Contam. Toxicol.* 26(5): 679-680; 1981 (6 references).

Levels of PCBs, HCB (hexachlorobenzene), and Σ DDT are reported for the fish lagesild *(Coregonus albula)* collected from 1974 to 1979 in Norway's Lake Mjosa, which has become highly polluted. Liver samples were analyzed by a gas chromatographic method. The data suggest that Σ DDT, PCBs, and HCB have decreased between 1974-1979 from 3.0 to 1.3 ppm, 6.7 to 3.4 ppm, and 0.12 to 0.11 ppm, respectively. However, this apparent tendency to decrease was shown by Wilcoxon's matched paired test not to be significant. Analysis indicates that a steady-state has been established for organochlorine levels in fish from this lake.

81-2450. Murray, H. E.; Ray, L. E.; Giam, C. S. (Dep. Chem., Texas A&M Univ., College Station, TX 77843) **Phthalic acid esters, total DDTs, and polychlorinated biphenyls in marine samples from Galveston Bay, Texas.** *Bull. Environ. Contam. Toxicol.* 26(6): 769-774; 1981 (10 references).

Data are presented on concentrations of phthalic acid esters, ΣDDT, and polychlorinated biphenyls (PCBs) in water and sediment samples collected from 8 sampling sites in Galveston Bay, Texas. ΣDDT in water ranged from < 0.01 to 3.5 ng/l, with an average concentration of 0.38 ng/l. These results generally fall within the range reported for the Mississippi Delta and Gulf Coast. PCB concentrations in water ranged from < 0.01 to 70 ng/l (average 3.1 ng/l). DEHP (dioctyl phthalate) concentrations ranged from < 2 to 12,000 ng/l (average 600 ng/l). In sediments, concentrations of ΣDDT ranged from 0.01 to 1.4 ng/l (average 0.21 ng/l). These results are substantially lower than those reported for the Mississippi Delta and the Gulf Coast. PCB sediment concentrations ranged from < 0.14 to 7.1 ng/g (average 1.1 ng/g). DEHP concentrations in sediments ranged from < 1 to 110 ng/g (average 22 ng/g).

81-2451. Felsot, A.; Maddox, J. V.; Bruce, W. (Sect. Econ. Entomol., Illinois Nat. Hist. Surv., Illinois Inst. Nat. Res., Champaign, IL 61820) **Enhanced microbial degradation of carbofuran in soils with histories of Furadan use.** *Bull. Environ. Contam. Toxicol.* 26(6): 781-788; 1981 (12 references).

Carbofuran persistence in soils with and without a history of Furadan (carbofuran) use was studied. Soils were collected from corn fields where Furadan had been used, a field where phorate had been used, and a field where no pesticides had ever been used. Samples were fortified with carbofuran and degradation rates were measured. Carbofuran was rapidly lost in the soils where Furadan was used; 80% was lost in 20 days and only traces were recovered after 30 days. Two species of bacteria, *Achromobacter* sp. and *Pseudomonas* sp., were isolated from the soils, and were capable of degrading carbofuran in pure culture. Studies are now being conducted to determine if the *Pseudomonas* sp. isolated can degrade other carbamate pesticides, and whether enhanced Furadan degradation as seen in the laboratory occurs in the field.

81-2452. Hlavsova, D.; Tucek, J.; Cerveny, V.; Dudacek, K. (Okres Hyg Stn., Okres Vet. Stn., Klatovy, Czechoslovakia) **Sledovani rezidui obsahu rtuti u skoto po zkrmovani obili moreneho Agronalem H. [Mercury residues in cattle after feeding Agronal H-treated grain.]** *Cesk. Hyg.* 26(2): 75-79; 1981 (12 references) (Czech).

Mercury residues in beef from cattle fed granulated feed containing 12% seed grain treated with Agronal H (phenylmercuric bromide) for a period of 3 wk were determined in 1020 muscle, liver and kidney tissue samples taken from 540 cattle. At the end of wk 3 mercury levels were found to be 2000 and 30 times the maximum permissible level in organs and muscle, respectively. Six mo later mercury residues in muscle dropped below 0.01 mg/kg; in organs the concentration remained 5 times higher than the permissible level. The decrease of mercury concentration in meat was found to depend more on weight gains than on time elapsed since the feeding of mercury-containing feed was discontinued. The overall quantity of contaminated feed ingested by the animals was found to be least important.

81-2453. Wallnoefer, P. R.; Ziegler, W.; Engelhardt, G. (Bayer. Landesanst. Bodenkult & Pflanzenbau, Abt. Pflanzenschutz, D-8000 Munich 19, BRD) **Bacterial oxidation of 4-methylthio-substituted veratylglycerol-β-arylethers, model compounds for soil bound pesticide residues.** *Chemosphere* 10(4): 341-346; 1981 (8 references).

The bacterial degradation of some thiomethyl-substituted veratylglycerol-β-arylethers, which were synthesized as possible models for soil-bound phenolic pesticide residues, was studied in laboratory cultures. Degradation of the model phenols was monitored by thin layer chromatography and quantitative UV-analysis. Two of the model compounds were transformed to their corresponding sulfoxides. The results suggest that bound residues of phenolic metabolites derived from insecticides containing a methylthioaryl- group may be immobilized more extensively than other phenolic compounds such as 2,4-dichlorophenol.

81-2454. Paasivirta, J.; Sarkka, J.; Aho, M.; Surma-Aho, K.; Tarhanen, J.; Roos, A. (Dep. Chem., Univ. Jyvaskyla, SF40100 Jyvaskyla 10, Finland) **Recent trends of biocides in pikes of the Lake Paijanne.** *Chemosphere* 10(4): 405-414; 1981 (13 references).

Pike (*Esox lucius*) from Lake Paijanne, Finland were analyzed for total mercury, methylmercury, hexachlorobenzene, DDE, PCB, and chlorophenolic residues by gas chromatography. Pike from all sections of the lake showed an 82-84% methylation of their mercury residues. Comparisons with previous studies conducted on Lake Paijanne revealed a decreasing trend of mercury levels from 1970 to 1980. Covariance analysis of DDE and PCB levels in pike showed a slight increasing trend when the effects of fat content was disregarded. Hexachlorobenzene and PCP were also noted in fish from all sampling sites, but all other chlorophenols were abundant only in fish from an area contaminated by pulp mill effluents.

81-2455. Kotzias, D.; Nitz, S.; Korte, F. (Inst. Okol. Chem., Ges. Strahlen & Umweltforsch. Muenchen, D-8050 Freising-Attaching, BRD) **Lichtinduzierter totalabbau**

organischer molekuele adsorbiert an kieslgel. [Light-induced total decomposition of organic molecules adsorbed on silica gel.] *Chemosphere* 10(4): 415-422; 1981 (10 references) (German).

The light-induced mineralization of ^{14}C-labeled organic substances adsorbed on silica gel was studied by UV irradiation ($\lambda > 290$ nm) and measurement of the CO_2 formed as end product. The mineralization after 17-hr exposure, expressed as % CO_2, was 5.4% for DDT (applied concentration: 83 ng/g silica gel), 6.4% for γ-hexachlorocyclohexane (lindane: 33 ng/g), and 39.3% for atrazine (350 ng/g). The results showed a good reproducibility. The method can be used under standardized conditions as a test method for the study of the photochemical mineralization of organic substances.

81-2456. Edgren, M.; Olsson, M.; Reutergardh, L. (Natl. Swedish Environ. Prot. Board, S-170 11 Drottningholm, Sweden) **A one year study of the seasonal variation of sDDT and PCB levels in fish from heated and unheated areas near a nuclear power plant.** *Chemosphere* 10(5): 447-452; 1981 (10 references).

In a 1-yr study, the effects of heated discharge from a nuclear power plant on the residual levels of the environmental contaminants ΣDDT and PCB in the fish *Perca fluviatilis* (perch) and *Leuciscus rutilis* (roach) were determined. Monthly collections of fish were made using bottom nets in the cooling-water intake area and the cooling-water recipient area (which shows a temperature elevation in the range of 4 to 10°C). Generally, 15 fish/area/mo were analyzed for ΣDDT and PCBs, and the Wilcoxon-signed- ranks test was applied to the data to determine the significance of the differences. The monthly mean values for the ΣDDT and PCB in perch were significantly higher in the recipient area than in the intake area. No significant differences could be established for roach. Seasonal variations in ΣDDT and PCB levels (highest during spring and early summer) are described, and it is stressed that monitoring should be carried out during ecologically stable periods.

81-2457. Zepp, R. G.; Schlotzhauer, P. F. (Environ. Res. Lab., US EPA, Athens, GA 30613) **Effects of equilibration time on photoreactivity of the pollutant DDE sorbed on natural sediments.** *Chemosphere* 10(5): 453-460; 1981 (8 references).

Studies were conducted to assess the effects of equilibration time on the photoreactivity of DDE. DDE was introduced to clay-size sediment particles in concentrations of 5-10 μg/l. The DDE-suspension mixture was allowed to equilibrate with stirring. Photolysis was conducted with a 450-W, medium-pressure mercury lamp. Equations incorporating sorption kinetics can be used to describe the kinetics of the reactions. It appears that at equilibrium half of the sorbed DDE is in reactive sites, and the remainder in sites where the DDE is unreactive.

81-2458. Newton, I.; Bogan, J.; Marquiss, M. (Inst. Terr. Ecol., Monks Wood Exp. Stn., Abbots Ripton, Huntingdon PE17 2LS, England) **Organochlorine contamination and age in sparrowhawks.** *Environ. Pollut. Ser. A* 25(2): 155-160; 1981 (10 references).

Organochlorine contamination was analyzed with respect to age distribution of sparrowhawks in Scotland. Residues of *p,p'*-DDE, PCB and HEOD (from aldrin and dieldrin) in nest eggs were quantified. Levels of each of the organochlorine compounds were higher in eggs of 2-yr-old females than in eggs from 1-yr-old females. Levels decreased from age 2 to 5. Females aged 6 yr and older showed slightly increased levels of all 3 compounds. Several hypotheses as to why the levels are highest in the 2nd yr are discussed.

81-2459. Stout, V. F. (Northwest & Alaska Fish. Cent., Utilization Res. Div., Natl. Mar. Fish. Serv., NOAA, Seattle, WA) **Organochlorine residues in fishes from the northwest Atlantic Ocean and Gulf of Mexico.** *Fish. Bull.* 78(1): 51-58; 1980 (31 references).

Levels of ΣDDT, PCB, dieldrin, and endrin were examined in fillets of fishes caught in the northwestern Atlantic Ocean and northern Gulf of Mexico. Six marine species were examined, including gag, black grouper, red grouper, red snapper, king mackeral, and Spanish mackeral. Relatively low levels of ΣDDT and PCB were found. Of the 70 composite samples, only 29 contained > 0.05 ppm ΣDDT and 0.0 ppm PCB in the edible portions. Only one sample contained as much as 1 ppm ΣDDT and PCB. Red grouper contained the lowest levels of both chlorinated hydrocarbons. Dieldrin and endrin concentrations were also relatively low. The highest level of dieldrin (0.026 ppm) was found in king mackeral from Aransas Pass (TX); the highest level of endrin (0.026 ppm) was found in Spanish mackeral from Panama City (FL). The species with the highest lipid contents contained the highest concentrations of chlorinated hydrocarbons. In all cases but one the chlorinated hydrocarbon levels were substantially below the US FDA guidelines.

81-2460. Spynu, E. I.; Molozhanova, E. G. (All-Union Res. Inst. Pestic. Polymer. & Plast., Kiev, USSR) **Faktory, opredelyayushchie zagryaznenie pochvy pestitsidami. [Factors determining soil contamination with pesticides.]** *Gig. Sanit.* 46(5): 16-18; 1981 (6 references) (Russian).

The results of a comprehensive study of the rate of degradation of organochlorine and organophosphorus pesticides (OCP and OPP) in the soil are reported. OCP persisted in the soil for 1-8 yr. The persistence of pesticides was determined by the rate and schedule of application, crop type, soil properties, and the physico-chemical properties of the pesticide. Pesticide solubility in lipid-like compounds was found to be conducive to stable soil adsorption.

81-2461. Jankowski, C.; Klein, R.; Preussmann, R. (Inst. Toxicol. Chemother., German Cancer Res. Cent., Heidelberg, BRD) **Formation of *N*-nitroso compounds of the pesticides atrazine, simazine and carbaryl with nitrogen oxides.** *IARC Sci. Publ.* 31: 329-339; 1980 (9 references).

Model experiments were conducted to investigate the *in vitro* nitrosation of the pesticides atrazine, simazine and carbaryl by nitrogen oxides. Pesticide samples were exposed to nitrogen oxides in a reaction chamber. Filtered atmospheric air was drawn into the chamber. Nitric oxide was added to the air flow at a constant rate so that samples were exposed to 10 and 1 ppm nitrogen oxide concentrations. The detection limit for nitrosated pesticides was 2-5 ng. Pure carbaryl was nitrosated only to a very low extent. The nitrosation of the other substances approached saturation after various exposure times. Saturation may be due to the formation of a superficial layer of nitroso compounds and water. The nitrosation rates were inversely related to the moisture content of the air. The adsorption of water molecules on the crystal surfaces was proportional to the humidity. It is suggested that these adsorbed water molecules may strongly reduce direct contact of nitrogen oxides with the pesticide particles. It is concluded that at nitrogen oxide levels normally present in air nitroso products of these pesticides will be formed in amounts too small to be detected by available methods.

81-2462. Handa, S. K.; Awasthi, M. D.; Dikshit, A. K.; Verma, S. (Indian Agric. Res. Inst., New Delhi 110012, India) **Residues of carbaryl and fenitrothion in or on Indian colza crop.** *Indian J. Agric. Sci.* 50(11): 873-875; 1980 (6 references).

Indian colza was grown in plots and treated with carbaryl (0.125% and 0.25% at 1.37 and 2.75 kg AI/ha) and fenitrothion (0.05% and 0.1% at 0.55 and 1.10 kg AI/ha). The chemicals were applied at the flowering stage and again after 20 days. With this pattern of application, no residues of the pesticides were detected in the harvested seeds. Initial residues of 20.10 ppm from 0.125% carbaryl had declined by 35.32% after 3 days. Initial residues of 9.25 ppm fenitrothion on leaves from 0.05% treatment declined by 45.94% in 3 days.

81-2463. Lincer, J. L.; Zalkind, D.; Brown, L. H.; Hopcraft, J. (P.O. Box 8, Sarasota, FL 33578) **Organochlorine residues in Kenya's Rift Valley lakes.** *J. Appl. Ecol.* 18(1): 157-171; 1981 (29 references).

Samples from various organisms at several trophic levels were analyzed for organochlorine pesticides in Lakes Naivasha, Nakuru, Baringo, and Elmenteita, Kenya. These lakes lie in the Rift Valley, and are closed basin systems with no external outlet. Lakes Naivasha and Baringo are fairly fresh; Lakes Nakuru and Elementeita are strongly alkaline. Forty-seven percent of the farms surveyed in the Nakuru catchment basin used either DDT or dieldrin to control cereal pests. Toxaphene, the most commonly used acaricide, was used in 90 cattle dips for a total of 16,700 kg of the concentrate/yr. Delnav (dioxathion) was also used at rate of 5430 kg/yr. DDE levels were fairly low, but were detected in algae, tilapia (Lake Naivasha), algae and corixid larva (Lake Nakuru), and vegetation (Lake Baringo). DDE levels were higher in bottom-feeding fish and ferns. Among bird eggs samples, the lowest DDE levels were from the Lake Naivasha cattle egrets (0.22 mg/*l*) and the highest from Lake Nakuru African darter (5.75 mg/*l*). Lake Nakuru generally showed higher DDE levels than Lakes Naivasha and Baringo. Biological magnification was noted in various lake food chains. A need to establish a periodic monitoring program for contaminants in the African nations is noted.

81-2464. Lay, J. P.; Klein, W.; Korte, F.; Richter, E. (Ges. Strahlen Umweltforschung mbH, Munchen Inst. Okol. Chem., D-8042 Neuherberg, Germany) **Metabolism of β-hexachlorocyclohexane-^{14}C in rats following low dosing in the daily diet.** *J. Environ. Sci. Health B* 16(3): 227-238; 1981 (21 references).

Rats received C-14 labeled, β-hexachlorocyclohexane (β-BHC) in their diets for 1 wk. Three therapeutic agents were also fed to the rats to enhance clearance during the elimination phase. For 8 wk, the renal and fecal excreted radioactive products were collected and extracted. Significant differences were noted in the total excreted amount of radioactivity in controls and treated rats. However, there was no quantitative difference in the extractability of the excreta and no differences in the chemical nature of the metabolites found. In urine the radioactivity consisted of 100% conversion products, about 30% of which were unextractable residues. The organic soluble fraction contained 2,4,6-trichlorophenol as the major metabolite in the urine and as the only metabolite in feces. A trichlorohydroxymethoxybenzene, a dichlorophenol, and a trace of a tetrachlorocyclohexane isomer were among the minor conversion products of β-BHC in urine.

81-2465. Geen, G. H.; Hussain, M. A.; Oloffs, P. C.; McKeown, B. A. (Dep. Biol. Sci., Simon Fraser Univ., Burnaby, British Columbia V5A 1S6, Canada) **Fate and toxicity of acephate (Orthene) added to a coastal B. C. stream.** *J. Environ. Sci. Health B* 16(3): 253-271; 1981 (5 references).

Acephate was added to Hidden Creek, a tributary of the Fraser River, to simulate the effect of an aerial spray program. Yearling rainbow trout were placed in screen cages in the creek 24 hr before acephate treatment. Acephate was then applied as commercial formulation Orthene 75S for 5 hr at a calculated concentration of 1000 ppb. The chemical was rapidly taken up by fish, sediments, insect nymphs, and insect larvae. No fish or insect mortali-

ty was noted, even though the more toxic methamidophos was found in both groups. Acephate and methamidophos residues in animals and sediments declined to trace or nondetectable levels in 24 hr. Residues in water were nondetectable by 96 hr. The impact of acephate on the stream and its fauna was limited and localized.

81-2466. Miles, J. R. W.; Bowman, B. T.; Harris, C. R. (Res. Inst., Agric. Canada, London, Ontario, Canada) **Adsorption, desorption, soil mobility and aqueous persistence of fensulfothion and its sulfide and sulfone metabolites.** *J. Environ. Sci. Health B* 16(3): 309-324; 1981 (12 references).

A description is given of soil/water interactions with fensulfothion and its sulfide and sulfone metabolites. Three soils and a stream sediment were used as adsorbents: Planefield sand, Big Creek sediment, Bondhead sandy loam, and muck soil. In general an inverse relationship was noted between water solubilities of the 3 chemicals and their adsorption K values. The order of adsorption was found to be fensulfothion sulfide > fensulfothion sulfone > fensulfothion. Soil organic content and adsorption K values were closely correlated. Desorption of fensulfothion and the sulfone were similar. The less soluble sulfide desorbed to a lesser extent. A desorption index was developed to facilitate comparisons of desorption tendencies of the 3 compounds. The water solubilities of the chemicals and their mobilities through the soils were directly related. Mobilities in decreasing order were fensulfothion > sulfone > sulfide. The persistence of fensulfothion was similar in both sterile and nonsterile water, with about 50% remaining at the end of 16 wk. Under reducing conditions, fensulfothion disappeared from water in 8-12 wk with almost complete conversion to the sulfide.

81-2467. Matthews, E. W.; Faust, S. D. (Dep. Environ. Sci., Cook Coll., Rutgers Univ., New Brunswick, NJ) **The sorption of Zectran on bottom sediments and peat moss.** *J. Environ. Sci. Health B* 16(3): 325-336; 1981 (8 references).

Errors in analysis of the insecticide Zectran (mexacarbate) in natural waters have been attributed to particulate matter in these waters. A series of laboratory experiments was performed to determine Zectran sorption isotherms with dried bottom sediments and a peat moss. The data demonstrated that Zectran does sorb onto particulates, according to the amount of organic matter measured as chemically oxidizable carbon. However, sorption on low organic sediments was too low to be considered a significant interference in the analysis by the abbreviated leuteoarsenotungstic (LAT) method. These findings suggest that particulates may not be the primary interference in the modified analytical method.

81-2468. Greenhalgh, R.; Read, D. C. (Chem. & Biol. Res. Inst., Agric. Canada, Ottawa, Ontario K1A OC6, Canada) **Persistence of fensulfothion in a sandy-loam soil and uptake by rutabagas, carrots and radishes using microplots.** *J. Environ. Sci. Health B* 16(3): 363-379; 1981 (15 references).

Field microplots were treated with 141 and 282 ppm fensulfothion (FSO) and 37.1 and 74.2 ppm fensulfothion sulfone (FSO_2). The soil in the microplots consisted of 67.1% sand, 25.1% silt, 7.8% clay, and 2.6% organic matter. The pH of the soil was 5.7. The water content of the air-dried soil samples ranged from 0.9 to 1.8%. The treatment concentrations corresponded to field treatment rates of 8.48 and 16.96 kg FSO/ha, and 2.23 and 4.47 kg FSO_2/ha. In this study the calculated half-life values for FSO were 35 and 39 days, respectively for the 8.48 and 16.96 kg AI/ha treatments in 1978, and 31 and 30 days in 1979. The weather during 1979 was considerably more wet than it had been during 1978. A calculated half-life of 14-23 days was found for FSO_2, which was less than that of the parent insecticide. FSO_2 and sulfide were the main derivatives found in FSO-treated soil.

81-2469. Beutler, J. A.; Varano, A.; DerMarderosian, A. (Dep. Biol., Philadelphia Coll. Pharm. & Sci., Philadelphia, PA) **Pyrolysis analysis of the herbicide paraquat on *Cannabis* spp. by coupled gas chromatography-infrared spectroscopy.** *J. Forensic Sci.* 24(4): 808-813; 1979 (19 references).

Gas chromatographic analysis coupled with infrared spectral identification was performed on samples of Mexican marijuana (*Cannabis*) contaminated with paraquat. Two peaks were obtained, one of which was retained for several minutes on the column, depending on the temperature. Stop flow examination of the first peak, which was not retained on the column, resulted in a spectrum identical to the standard gas-phase spectra of chloromethane. The retained peak was identified as 4,4'-dipyridyl, a compound of uncertain toxicity. The toxic effects of chloromethane, which is also a common constituent of tobacco smoke, should be similar for both paraquat-contaminated and uncontaminated marijuana.

81-2470. Inoue, S.; Watanabe, S.; Ikeda, H. (Kanagawa Prefect. Inst. Public Health Yokohama, Kanagawa, Japan) **[Statistical studies on pollution by organochlorine pesticides in human and cow milk.]** *Kanagawa-ken Eisei Kenkyusho Kenkyu Hokoku (Bull. Kanagawa Prefect. Public Health Lab.)* 10: 1-4; 1980 (7 references) (Japanese).

Around 1971 the highest pollution levels by organochlorine pesticides in food were recorded in Japan. The levels of ΣBHC, ΣDDT, and dieldrin in cow's milk were 0.056, 0.006 and 0.0014 ppm, respectively. Since then, the pollution has been reduced; such pesticides are still detected in cow's milk at very low levels and in human milk at high levels. Data was collected from 1972 to 1979 and analyzed statistically. For cow's milk, regression analysis

for the yearly variation of these pesticides in Kanagawa Prefecture showed an exponential regression curve. Since the human body is subject to pollution by various foods, observations of pesticide levels in human milk were made. Student's t-test was applied on the difference between the mean values of the pesticides in human milk and those in cow's milk. According to the results, the former was significantly higher than the latter. The same statistical procedure performed on data from all of Japan revealed a similar tendency.

81-2471. Watanabe, S.; Watanabe, S.; Ikeda, H. (Kanagawa Prefect. Public Health Lab. Yokohama, Kanagawa, Japan) **[Effluence of herbicides to water course.]** *Kanagawa-ken Eisei Kenkyusho Kenkyu Hokoku (Bull. Kanagawa Public Health Lab.)* 10: 53-56; 1980 (5 references) (Japanese).

Levels of chlomethoxynil and benthiocarb were determined in the effluent of 4 model flooded paddy fields. In field 1, no cultivation was carried out and herbicide was applied twice; in field 2, cultivation was carried out and no herbicide was applied; in field 3, no fertilizer was applied and herbicide was applied twice; in field 4, no rice plants were transplanted and herbicide was applied twice. The herbicides were applied as granular preparations containing 7% and 10% of the active ingredients, respectively; the amount applied was 4 kg granules/4.05 ha (10 acres). In the effluents of fields 1, 3, and 4, chlomethoxynil was detected for 60 days after the 2nd application. The concentration 2 days after the application was 2.2 ppb in field 4 and 17.6 ppb in field 3. After 11 days levels were 10.7 in field 4 and 12.8 in field 3. After 60 days 0.2 ppm remained in field 4. In the effluents of fields 1, 3, and 4, benthiocarb was detected for about 50 days after the 2nd application; after 1 day levels were 195 ppb in field 1, 305 ppb in field 3 and 290 ppb in field 4. After 50 days trace amounts were found in fields 1, 3, and 4. Simetryne, contained in benthiocarb at 1.5%, was detected for 30 days after application; after 1 day levels were 125 ppb in field 1, 360 ppb in field 3, and 290 ppb in field 4; after 30 days, trace amounts were found in fields 1 and 3, and 1.5 ppb in field 4. There have been no reported instances of chlomethoxynil detection in river water however. These results suggest that it could be detected for a longer period after application than benthiocarb, although at a very low level. The level of application of chlomethoxynil indicates there may be some pollution of water systems.

81-2472. Watanabe, S.; Kaise, R.; Watanabe, S.; Ikeda, H. (Kanagawa Prefect. Inst. Hyg., Yokohama, Kanagawa, Japan) **[Results of investigation on pesticide residues on or in vegetables and fruits.]** *Kanagawa-ken Eisei Kenkyusho Nempo (Annu. Rep. Kanagawa Prefect. Inst. Hyg.* 29: 45; 1979 (Japanese).

Examination was made of pesticide residues in or on 62 samples of 19 kinds of vegetables and fruits. Fenitrothion was detected in Japanese pear at 0.089 ppm and dicofol was detected in cucumber at 0.26 ppm; both values were below the standard. Dieldrin was found in cucumber at 0.045 ppm; the green house which supplied the specimen was reinvestigated. The average amount of dieldrin in or on cucumbers from the greenhouse was 0.022 ppm (0.013-0.033 ppm). Carbaryl was detected on 4 of 20 specimens (8 species) at 0.01 ppm. Arsenic and lead were examined on 22 specimens of 6 species; arsenic was detected in one specimen at 1.5 ppm. Lead was detected in 14 specimens at 0.01-0.67 ppm.

81-2473. Inoue, S.; Watanabe, S.; Ikeda, H. (Kanagawa Prefect. Inst. Hyg., Yokohama, Kanagawa, Japan) **[Results of investigation on pesticide residues in cow milk.]** *Kanagawa-ken Eisei Kenkyusho Nempo (Annu. Rep. Kanagawa Prefect. Inst. Hyg.)* 29: 45; 1979 (Japanese).

α-BHC was detected in 9 of 10 cow's milk specimens at an average of 0.003 ppm [range 0.005 to not detectable(nd)]. β-BHC was detected in 4 of 10 specimens at an average of 0.001 (range 0.001 to nd). γ-BHC was not detected at all. Σ, DDT was detected in 5 of 10 specimens at 0.001 ppm. Dieldrin was detected in 1 of 10 specimens (range 0.001 to nd). In a second investigation, α-BHC was detected in 3 of 10 specimens at an average of 0.0003 ppm (range 0.0010 to nd). β-BHC was detected in 2 of 10 specimens (range 0.001 to nd); γ-BHC was not detected in 10 of 10 specimens. ΣDDT was detected in 7 of 10 specimens at an average of 0.001 ppm (range 0.002 to nd). Dieldrin was detected in 4 specimens (range 0.001 to nd). *o,p'*-DDT, aldrin and endrin were not detected in either investigation.

81-2474. Inoue, S.; Watanabe, S.; Ikeda, H. (Kanagawa Prefect. Inst. Hyg., Yokohama, Kanagawa, Japan) **[Results of investigation on pesticide residues in rainbow trout.]** *Kanagawa-ken Eisei Kenkyusho Nempo (Annu. Rep. Kanagawa Prefect. Inst. Hyg.)* 29: 45-46; 1979 (Japanese).

Pesticide residues in rainbow trout grown in a fish farm in Kanagawa Prefecture were measured. Σ BHC was detected in 7 of 10 specimens at an average value of 0.001 ppm [range 0.004 ppm to not detectable(nd)]. Σ DDT was detected in 9 of 10 specimens at an average value of 0.007 ppm (range 0.011 ppm to nd). Dieldrin was detected in 2 of 10 specimens (range 0.002 ppm to nd). The average value of residual ΣDDT was particularly high.

81-2475. Inoue, S.; Watanabe, S.; Ikeda, H. (Kanagawa Prefect. Inst. Hyg., Yokohama, Kanagawa, Japan) **[Results of investigation on pesticide residues in mother's milk.]** *Kanagawa-ken Eisei Kenkyusho Nempo (Annu. Rep. Kanagawa Prefect., Inst. Hyg.)* 29: 47; 1979 (Japanese).

Contamination of human milk by PCB and organochlorine pesticide residues was investigated in 1979. Six specimens were obtained from mothers 1-4 mo after delivery. ΣBHC was at an average of 0.024 ppm (range 0.014 to 0.039 ppm). ΣDDT was detected at an average of 0.040 ppm (range 0.025 to 0.081 ppm). Dieldrin was detected at an average of 0.001 ppm (range, not detectable to 0.03 ppm). Including the present study, results since 1972 do not show a conspicuous change in these levels with time.

81-2476. Kawana, K.; Nakaoka, M.; Ikeda, H. (Kanagawa Prefect. Inst. Hyg., Yokohama, Kanagawa, Japan) **[Results of investigation on the residues of biphenyl, *o*-phenylphenol and thiabendazole in or on citrus fruits.]** *Kanagawa-ken Eisei Kenkyusho Nempo (Annu. Rep. Kanagawa Prefect. Inst. Hyg.)* 29: 51; 1979 (Japanese).

Pesticide residues in citrus fruits were studied. Biphenyl was detected in 7 of 11 lemons, 9 of 10 oranges, and 5 of 10 grapefruits. o-phenylpheno was detected on 7 of 11 lemons, 5 of 10 oranges, and 2 of 10 grapefruits. Thiabendazole was not detected on any fruits. Pesticide residues were > 10 ppm and < 30 ppm in 1 lemon, 5 oranges, and 3 grapefruits. All the fruits passed the standard examination.

81-2477. Kurdyukov, V. V. (All-Union Res. Inst. Plant Prot., Leningrad, USSR) **Izmeneniya v agrotsenoze pod vliyaniem pestitsidov. [Changes in agrocenosis induced by pesticides.]** *Khim. Sel'sk. Khoz.* 19(4): 47-50; 1981 (33 references) (Russian).

Ecological aspects of pesticide application are reviewed. Repeated application of organochlorine and organophosphorus insecticides caused marked changes in the species composition of pest and beneficial insects, and thus reduced the ecological stability of the community. Similar changes were recorded after repeated application of herbicides. Repeated application of 2,4-D was found to increase the number of beneficial soil actinomyces. Application of dalapon and sodium trichloroacetate for 3 yr inhibited certain soil microflora (*Azobacter*, fungi, and ammonifying, and denitrifying microflora).

81-2478. Mozhaev, V. G. (Western-Siberian Branch Agrosilviculture, USSR) **Vliyanie gerbitsidov na sodezkhanie azota i fosfora v kashtanvykh pochvakh na lesopolosakh. [Effect of herbicides on the level of phosphorus and nitrogen in chestnut soil of forest sections.]** *Khim. Sel'sk. Khoz.* 19(4): 50-51; 1981 (7 references) (Russian).

The effect of the herbicides atrazine, prometryne, simazine, and dalapon on nitrogen and phosphorus levels was studied in a chestnut soil of a forest section. Within the first 2 wk after herbicide application, atrazine and prometryne stimulated nitrification. Simazine and dalapon inhibited nitrification slightly. Dalapon caused a 37% increased of the level of P_2O_5.

81-2479. Stout, V. F.; Beezhold, F. L. (Util. Res. Div., Northwest & Alaska Fish. Cent., Natl. Mar. Fish. Serv., Seattle, WA) **Chlorinated hydrocarbon levels in fishes and shellfishes of the Northeastern Pacific Ocean, including the Hawaiian Islands.** *Mar. Fish. Rev.* 43(1): 1-12; 1981 (31 references).

Marine animals were obtained from a variety of sources, including research vessels, commercial fishermen, and fish processors. Tissue samples were subjected to chlorinated hydrocarbon analysis. Low levels of these pollutants were found in shellfish from several coastal areas of the northeastern Pacific Ocean. In most cases the values were the quantifiable limit of 0.01 ppm for ΣDDT and 0.05 ppm for PCB. Limited dilution of pollutant-laden run-off may account for the low but measurable levels of PCB in marine animals from Puget Sound and Hood Canal. Highest levels of PCB were found in Elliott Bay, the main deepwater harbor area of Seattle, Washington. ΣDDT levels in edible tissue exceeded the FDA guideline of 5 ppm only in fishes taken from the vicinity of the Los Angeles County sewer outfalls, where commercial fishing is restricted to bait fishing. Only in goatfish from Hawaii did the PCB level exceed the proposed FDA guideline of 2 ppm. Significant positive associations were noted between physical measurements and chlorinated hydrocarbon content existing in lingcod and striped bass from Oregon, in albacore from northern California, in bocaccio, and in one set of 25 jack mackerel from southern California. Significant positive associations often existed between chlorinated hydrocarbons.

81-2480. Schuepbach, M. R. (Kant. Lab. Basel-Stadt, CH-4012 Basel, Switzerland) **Toxische Spurenstoffe in der Nahrung. Versuch einer Standortbestimmung. [Toxic trace substances in food. Analysis of the situation.]** *Mitt. Geb. Lebensmittelunters. Hyg.* 72(1): 2-21; 1981 (29 references) (German).

Recent studies on toxic substances in foodstuffs are reviewed. Many toxic substances, including PCBs and organochlorine pesticides, accumulate in trophic chains. DDT (3 ppm), PCB (2 ppm), hexachlorobenzene (0.54 ppm), dieldrin (0.04 ppm), heptachlor epoxide (0.03 ppm), and hexachlorocyclohexane (BHC; 0.36 ppm) were found in human milk (fat basis). The acceptable daily intake for DDT was exceeded by 408%, for hexachlorobenzene by 612%, and for dieldrin by 272%.

81-2481. Wilson, P. R. (Ecol. Div., DSIR, Nelson, New Zealand) **Effects on birds of spraying DDT and DDD in orchards.** *N. Z. J. Ecol.* 3: 117-124; 1980 (14 references).

Ten soil cores were collected at random at each of 33 sites selected to cover all parts of an orchard. Residues of DDT and metabolites were determined in these core samples using gas chromatography. Adult mynas (*Acridothere tritis L*), eggs, and nestlings were collected, examined for morphological changes, and tested for pesticide residues. The average pesticide content of soil samples ranged from < 0.01 ppm, in areas planted for only one season, to 28.2 ppm, in a block of orchard sprayed for 18 yr. Some adult starlings, blackbirds, and song thrushes died in tremors typical of organochlorine poisoning, but no mynas were seen with these symptoms. Earthworms readily accumulate DDT, DDD (TDE), and DDE from the soil, but they are less frequently eaten by mynas than by these other species of birds. However, in areas where higher residues of DDT and DDD were found in the soil, fewer myna eggs hatched, and fewer nestlings survived than in areas with lower soil contamination levels. Average concentrations in adult mynas was 4.1 ppm. In eggs, residues levels correlated with soil residue levels. In nestlings, residues were twice as high as in eggs in high-residue areas and similar to residues in eggs in low-residue areas.

81-2482. Misumi, J.; Kawakami, K.; Ueda, A.; Futatsuka, M.; Nomura, S. (Sch. Hyg., Fac. Med., Kumamoto Univ., Kumamoto, Japan) **[Working environment of workers engaging in fumigation of cereals with methyl bromide.]** *Nippon Eiseigaku Zasshi (Jpn. J. Hyg.)* 36(1): 433; 1981 (Japanese).

Aerial concentrations of methyl bromide in warehouses of cereals fumigated with methyl bromide and the concentration of Br in urine of the workmen engaged in the fumigation were determined. The internal volumes of the warehouses A, B, C, and D were 738, 738, 599, and 599 m^3; the amounts of methyl bromide released were 8, 8, 7, and 7 kg, respectively; the amounts of cereal in the warehouses were 79.5, 296.9, 207.0, and 243 tons, respectively. The aerial concentrations immediately after release were > 500 ppm; after 3 days, those in B, C and D showed reduced values (190-280 ppm). After 3 hr with the door open the concentration was reduced to < 50 ppm in every warehouse. The concentration in the air around the warehouses while the door was shut was < the limit of detection. Just after the door opened, the concentration at a point of 2 m from the door was 210-430 ppm; it was reduced to < 40 ppm within 30 min. Urine concentrations in 7 workers were 10.5 ± 2.2 before working, 11.5 + 2.9 3 hr after opening the door, 12.4 ± 3.3 mg/l 6 hr after opening the door, and 8.6 ± 5.7 mg/l. Because the time of exposure to fumigated air was brief, no appreciable increase of urinary Br of the workmen engaged in the fumigation was noted.

81-2483. Nambu, K.; Takimoto, Y.; Miyamoto, J. (Res. Dep., Pesticide Div., Sumitomo Chem. Co. Ltd., Takarazuka, Hyogo, Japan) **Degradation of phenothrin in stored wheat grains.** *Nippon Noyaku Gakkaishi (J. Pestic. Sci.)* 6(2): 183-191; 1981 (17 references).

Both ^{14}C-(+)-*trans*- and ^{14}C(+)-*cis*)- phenothrin were applied to wheat grain containing 11% moisture at the rate of 4 ppm; levels were monitored while the grain was stored in a dark room at 15 or 30°C. Both the isomers on the grain degraded slowly, after 12 mo, 79% and 97% of the 2 isomers, respectively, remained in the grain stored at 30°C. Both isomers were metabolized through the hydrolysis of ester linkage, the oxidation of benzyl alcohol to benzoic acid, and the methylation of benzoic acid. When applied with piperonyl butoxide or fenitrothion, the degradation of both isomers of phenothrin was suppressed somewhat. Both isomers and their degradation products remained for 12 mo in the seed coat of wheat grain; after milling, the residual amounts of both isomers in wheat flour and brain were 0.77 and 11.4 ppm, respectively. The residual pesticide in brain made from the flour was reduced to 0.57 ppm. When ^{14}C-malathion was applied in similar fashion on wheat grain, it degraded at a half-life of 8 mo when stored at 15°C and 11 mo at 30°C to form desmethylmalathion, monocarboxylic derivative, dicarboxylic derivative, and $^{14}CO_2$.

81-2484. Izawa, T.; Fujii, Y.; Asaka, S. (Ageo Res. Lab., Agrochem. Div., Nippon Kayaku Co. Ltd., Ageo, Saitama 362, Japan) **[Degradation of MCPBE, simetryne and methoxyphenone in reductive flooded soil.]** *Nippon Noyaku Gakkaishi (J. Pestic. Sci.)* 6(2): 223-226; 1981 (14 references) (Japanese).

Degradation of MCPBE (ethyl 2-methyl-4-chlorophenoxybutyrate) , simetryne, and methoxyphenone (3,3'-dimethyl- 4-methoxybenzophenone) in reductive flooded soil was compared to that in ordinary flooded soil. The half-life of MCPBE was < 1 day in either soil. Free acid from MCPBE was rapidly formed. Although 2-methyl-4-chlorophenoxyacetic acid was formed in the ordinary flooded soil, its formation was not observed at all in the reductive flooded soil. The presumed half-life of simetryne was about 37-63 days without any effect by soil conditions. Methoxyphenone was rapidly degraded in either soil to 3,3'-dimethyl-4-hydroxybenzophenone. The degradation of the 3 agrochemicals in reductive flooded soil resembled the degradation in ordinary flooded soil; as they do not remain for a long period in the reductive soil, the danger to rice plants would not be raised even if the soil becomes strongly reductive.

81-2485. Oshiro, Z. (Lab. Environ. Pollut., Okinawa Prefect. Inst. Public Health, Osato, Okinawa, Japan) **[Chlordane and environmental pollution. 1. Analytical method of chlordane and the present state of environmental pollution due to chlordane.]** *Okinawa-ken Kogai Eisei*

Kenkyushoho (Annu. Rep. Okinawa Prefect. Inst. Public Health) 14: 1-16; 1981 (16 references) (Japanese).

A substance which showed a chromatographic pattern similar to that of chlorinated biphenyl is present in untreated water and river beds in Okinawa. Chromatography confirmed that the substance is chlordane, used in large quantities in Okinawa as an insecticide against termites. The analytical method consists of decomposition with sodium hydroxide, extraction with hexane, condensation, column-chromatography, elution by hexane, and gas-chromatography; this method has a recovery rate of 90%. Residues of chlordane in public waters were on the average 0.09 ppb, similar to that of United States military bases. However, the rate of detection of chlordane in the US bases is 68%, compared with 12% in other Okinawan waters. Chlordane in fishes collected along the beach of the US bases was as high as 10-100 times that in fishes collected in the ordinary region. The amount of chlordane used in Okinawa Prefecture was 59 tons (calculated as pure substance). However, based on 1979 figures, no information can be obtained on the amount used by American bases.

81-2486. Holleman, J. W.; Hammons, A. S. (Oak Ridge Natl. Lab., Oak Ridge, TN) **Levels of chemical contaminants in nonoccupationally exposed US residents.** *ORNL/EIS* 142: 271 pp.; 1980 (356 references).

This report is a compilation of information on chemical contaminants found in nonoccupationally exposed US residents. Listed in tabular form for each of approximately 100 elements or compounds are: the tissue the compound was found in; the range and means or medians of concentrations found; the number of cases; the analytical methods used for detection, identification, and quantitation; the bibliographic reference; information on the source and route of entry of the contaminant into the environment and into man; epidemiological and demographical aspects; and other pertinent comments. Compounds considered include the aldrin, arsenic, BHC, dieldrin, heptachlor, heptachlor epoxide, hexachlorobenzene, Kepone (chlordecone), mirex, nonachlor, oxychlordane, PCP, and PCBs. Sources of literature used in the survey cover a 30-yr period, with the bulk of the studies coming from the past 10 or 15 yr. Some substances that are not necessarily contaminants are included in the report for scientific interest and to establish baselines.

81-2487. Walker, A.; Barnes, A. (Natl. Veg. Res. Stn., Wellesbourne, Warwick CV35 9EF, England) **Simulation of herbicide persistence in soil; a revised computer model.** *Pestic. Sci.* 12(2): 123-132; 1981 (14 references).

A mathematical model for predicting the persistence of a number of herbicides in soils in the field has been modified so that daily measurements of maximum and minimum air temperature and rainfall may be used as input variables, and the program has been rewritten in FORTRAN. In the revised program any rain is assumed to fall at an even rate during the 1st half of each day and evaporation is assumed to occur at an even rate during the 2nd half of each day. This procedure permits all rain, irrespective of the amount, to wet the soil and then to evaporate, thus simulating reality more closely. Good agreement was obtained between calculated and measured moisture contents and temperatures from Wellesbourne and from some sites in North America. The equations that were used to calculate the moisture content of surface soils were then incorporated into a simulation model for predicting herbicide persistence. Residues predicted by the model were not significantly different whether measured or calculated moisture contents and temperatures were used.

81-2488. Lethbridge, G.; Bull, A. T.; Burns, R. G. (Dep. Microbiol., Macauley Inst. Soil Res., Craigiebuckler, Aberdeen AB9 2QJ, Scotland) **Effects of pesticides on 1,3-β-glucanase and urease activities in soil in the presence and absence of fertilisers, lime and organic materials.** *Pestic. Sci.* 12(2): 147-155; 1981 (22 references).

The effects of 5 pesticides on 1,3-B-glucanase and urease activities in soil were investigated in the presence and absence of other soil treatments, including NPK fertilizer, urea, pig slurry, ground limestone, cellulose, and glucose. Soil samples were from a Hamble series silt loam soil, collected from the top 15 cm. The pesticides tested included 2,4-D, Avadex (di-allate), Roundup (glyphosate), suffix (benzoylprop-ethyl), and malathion. The formulations were applied to the soil in all or half of the water needed to bring the soil to 65% water holding capacity. None of the pesticides tested had any effect on the steady-state accumulated glucanase and urease activities of treated soil, whether air-dried, at field-wetness, or flooded, nor any effect on air-dried soil treated with NPK fertilizer or urea. The soil enzyme systems could only be disrupted by unrealistically high dosage rates of the active ingredients (0.1-1.0 g/kg soil). In tests with the active ingredients, 1,3-β-glucanase activity was enhanced by 2,4-D, inhibited by di-allate, benzoylprop-ethyl and malathion, but unaffected by glyphosate. Urease activity was inhibited by 2,4-D, but unaffected by di-allate, benzoylprop-ethyl and glyphosate. Malathion was not tested.

81-2489. Ford, M. G.; Greenwood, R.; Thomas, P. J. (Dep. Biol. Sci., Portsmouth Polytech., Portsmouth PO1 2DY, England) **The kinetics of insecticide action. Part I: the properties of a mathematical model describing insect pharmacokinetics.** *Pestic. Sci.* 12(2): 175-198; 1981 (19 references).

A simple 2-compartment model is presented to describe the movement of an insecticide from the insect surface (compartment 1) to the region within the insect (compartment 2). The model introduces a parameter to

represent the relative thermodynamic capacities of the compartments. First-order rate constants for penetration and elimination are assumed. The differential equations describing the rates of change of insecticide in each compartment after application of insecticide are solved analytically. Terms are derived that describe the integrals of compound mass in each compartment with time after application, the time to a maximum level of insecticide in compartment 2, and the distribution and loss of compound from the system with time. Further properties of the model with possible toxicological significance are identified, including the total integral for material in compartment 2, which depends only on the elimination rate constant and the applied dose.

81-2490. Harkness, G. J.; Wells, C. H. J. (Sch. Chem. & Phys. Sci., Kingston Polytech., Surrey KT1 2EE, England) **Rates of reaction of singlet oxygen with some systemic pyrimidine fungicides and related compounds.** *Pestic. Sci.* 12(2): 215-218; 1981 (20 references).

To test whether singlet oxygen may have a role in environmental photooxidations, rates of reaction were determined of singlet oxygen with the fungicides ethirimol and dimethirimol, and with 4 structurally related compounds [2-dimethylamino- 5,6-dimethylpyrimidin- 4-ol (III), 2-dimethylamino- 6-methyl-pyrimidin- 4-ol (IV), 4-benzyloxy-2-dimethylamino5, 6-dimethylpyrimidine (V), and 2-diethylamino- 6-methylpyrimidin- 4-ol (VI). Results show that singlet oxygen reacts readily with these compounds. One site of attack of singlet oxygen on the compounds may be at the 5,6-double bond. A slight difference in reaction rates for compounds III and V suggests that C-4 is not a primary site of attack by singlet oxygen. The mode of attack is currently being studied by separation and identification of the products formed. The possibility that singlet oxygen may react with agricultural chemicals under natural conditions is discussed.

81-2491. Roberts, T. R.; Standen, M. E. (Shell Res. Ltd., Shell Biosci. Lab., Sittingbourne Res. Cent., Sittingbourne, Kent ME9 8AG, England) **Further studies of the degradation of the pyrethroid insecticide cypermethrin in soils.** *Pestic. Sci.* 12(3): 285-296; 1981 (6 references).

Studies of the degradation of the pyrethroid insecticide cypermethrin (NRDC 149) and its *cis*- and *trans*-isomers (NRDC 160 and NRDC 159, respectively) have been extended. In soils stored in the laboratory for up to 52 wk cypermethrin continued to be degraded by hydrolysis and oxidation. A previously unidentified product has now been identified as the dicarboxylic acid 3-(2,2-dichlorovinyl) -1-methylcyclopropane- 1,2-dicarboxylic acid. Comparative experiments carried out under indoor and outdoor conditions showed that essentially the same products were formed under these different conditions. However, α-carboxy-3-phenoxybenzyl 3(2,2-dichlorovinyl) -2,2-dimethylcyclopropanecarboxylate was one minor product detected only under outdoor conditions. Evidence is presented for the further degradation of bound residues arising in soil from cypermethrin treatments. There was limited uptake of the radiolabel into wheat grown in soil containing radiolabeled bound residues. (Author abstract by permission)

81-2492. Sen, D.; Wells, C. H. J. (Sch. Chem. & Phys. Sci., Kingston Polytech., Kingston upon Thames, Surrey KT1 2EE, England) **Photo-dimers from the photolysis of 2-dimethylamino- 5,6-dimethylpyrimidin- 4-ol in aqueous solution.** *Pestic. Sci.* 12(3): 339-345; 1981 (14 references).

2-Dimethylamino-5,6-dimethylpyrimidin-4-ol (I) is a hydrolysis product of the pesticide pirimicarb, and may be formed in the environment. Photolysis of I in degassed aqueous solution yields 2 isomeric photo-dimers which are formed by dimerization across the 5,6-double bond of I. The yield of dimers is dependent upon the initial concentration of I and on the temperature; this can be explained in terms of a mechanism whereby pyrimidinol aggregates react to give dimers. The formation of aggregates can account for the fact that the quantum yield for the overall reaction of I was higher in degassed acetonitrile than in degassed aqueous solution, it can also account for four photo-dimers being formed in the former solvent and only two in the latter solvent. The photo-dimers revert to I when heated or on photolysis. That photo-dimers are not found under natural conditions in the environment is considered to be partly because oxygen may react competitively with photo-excited pyrimidinol species and so prevent dimerization. (Author abstract by permission)

81-2493. Anonymous **Chemical levels drop in Ohio River fish.** *Public Works* 112(5): 130-132; 1981.

A 1980 study suggests that fish populations in the Ohio River are less contaminated with organic chemicals than they have been in earlier studies. Fewer fish analyzed were found to contain levels of chemicals in excess of US FDA guidelines for human consumption. The study included fish collection and identification at 6 sites on the river. Trace amounts of PCBs were found in all samples, with an average value of 1.1 ppm. Chlordane concentrations were over the FDA limit of 0.30 ppm in 3 catfish. Chlordane was detected in all fish sampled, though often in amounts too small to measure.

81-2494. Crosby, D. G.; Beynon, K. I.; Greve, P. A.; Korte, F.; Still, G. G.; Vonk, J. W. (Dep. Environ. Toxicol., Univ. California, Davis, CA 95616) **Environmnetal chemistry of pentachlorophenol. A special report on pentachlorophenol in the environment.** *Pure Appl. Chem.* 53(5): 1051-1080; 1981 (219 references).

PCP is produced on a multimillion kg annual scale, is acutely toxic to all life forms,, and is exceptionally persistent in the environment. The environmental impact of PCP is considered in light of its various uses, chemical and physical properties, biological uptake and transformation of its impurities, analytical methods for analysis of PCP and its impurities, residues of PCP and associated compounds, and recommendations for its safe use. Of particular concern are the chlorinated dioxin and dibenzofuran impurities. Many impurities are potentially dangerous through oral or dermal exposure; no inhalation data have been reported on most. The most toxic of the impurities is TCDD. Sophisticated analytical methods to detect these dibenzodioxins and dibenzofurans have not been widely applied, and evidence of the environmental occurrence of these substances is scattered. Residues of PCP have been found in various foods, water, rainfall, lumber, and bedding material; PCP can be a serious hazard for unprotected occupationally exposed workers.

81-2495. Norris, L. A. (Pac. Northwest For. & Range Exp. Stn., For. Serv., USDA, Corvallis, OR 97331) **The movement, persistence, and fate of the phenoxy herbicides and TCDD in the forest.** *Residue Rev.* 77: 65-135; 1981 (212 references).

Published data on the behavior of phenoxy herbicides and TCDD in the forest environment are reviewed. Despite the large number of citations in this review, not all aspects of this topic have been fully cited. The greatest strengths in the literature involve 2,4,5-T movement and persistence in the major forested regions of the United States. Both the magnitude and duration of exposure that organisms are likely to receive can be estimated with the available data. Despite the fact 2,4-D is used far more extensively than 2,4,5-T, it has received substantially less research attention. Dichloroprop, silvex (carbaryl), MCPA, and other phenoxy herbicides have received little attention in forest environment research; but their scope of use is limited and the data for their di- and tri- chlorinated phenoxyacetic acid relatives provide a reasonable basis for prediction. In forest applications, phenoxy herbicides are distributed initially among 4 major compartments: air, vegetation, forest floor and soil, and water. Most of the herbicide ends up in the forest floor and soil. In all compartments, the phenoxy herbicides are relatively rapidly decomposed, and there appears to be little opportunity for substantial exposure to these chemicals. A fairly extensive data base is available to establish the specific levels of phenoxy herbicide likely to occur in any one location at a particular time after application. TCDD, the highly toxic contaminant of 2,4,5-T and silvex, has also been intensively studied, but little of this work has been done in the forest. The initial levels and persistence of TCDD in specific forest compartments can be estimated from laboratory and field studies. Bioaccumulation of TCDD is expected to occur if organisms are exposed to a substantive, continuing source of TCDD, but it has not been detected (extensively) from normal patterns of herbicide use. The most glaring deficiencies in the data base for the phenoxy herbicides involve residues and fates of herbicides in air, fates of herbicides in forest streams (including sediment and biota), and residues and fates of TCDD in all forest compartments. (Author abstract by permission, abridged)

81-2496. Kerkhoff, M.; De Boer, J.; Geerdes, J. (Netherlands Inst. Fish. Invest., 1976 CP IJmuiden, The Netherlands) **Heptachlor epoxide in marine mammals.** *Sci. Total Environ.* 19(1): 41-50; 1981 (18 references).

Three juvenile harbor seals and 5 adult white-beaked dolphins were sampled. Blubber, liver, and brain samples of the seals and blubber samples of the dolphins were collected. Heptachlor epoxide concentrations in the seals were confirmed by chemical derivatization and mass spectrometric analyses. An unknown compound close to that of heptachlor epoxide interfered in the determination of electron capture detector gas chromatography. On a WCOT CP-Sil 7 column programmed from 85 to 175°C, 2 poorly separated peaks could be detected. Heptachlor epoxide contents up to 1.7 mg/kg were obtained, which were about 200 times lower than the PCB levels. The same ratio was noted in fish from the same area.

81-2497. Takahashi, K.; Suzuki, T.; Meguriya, N. (Sendai Munic. Inst. Public Health, Sendai, Miyagi, Japan) **[Result of investigation on pentachlorophenol in water for irrigation and in soil of paddy field.]** *Sendai-shi Eiseishikensho Shoho (Annu. Rep. Sendai Munic. Inst. Public Health)* 9: 146-150; 1979 (2 references) (Japanese).

Residues of pentachlorophenol (PCP) in 36 samples of water for irrigation collected in 1979 and 16 paddy field soil samples collected in 1978 were investigated by methods giving average recoveries of 84.1 and 90.8%. Pentachlorophenol levels in irrigation water ranged from 8.5 to 29.1 pg/ml. Pentachlorophenol levels in paddy soil field ranged from not detectable to 0.28 ng/g, except for one sample containing 2.10 ng/g.

81-2498. Hiroshima, K.; Konno, K.; Mishima, Y.; Meguriya, N. (Sendai Munic. Inst. Public Health, Sendai, Miyagi, Japan) **[Results of investigation of pesticide residues. Part 7. Organochlorine compounds in beef and pork.]** *Sendai-shi Eiseishikensho Shoho (Annu. Rep. Sendai Munic. Inst. Public Health)* 9: 217-223; 1979 (4 references) (Japanese).

Residues of α-, β-, γ- and δ-BHC (hexachlorocyclohexane, HCH), *p,p'*-DDT, *p,p'*-DDE, *p,p'*-DDD (*p,p'*-TDE), dieldrin and PCB were determined in 100 samples of muscle, adipose tissues, liver and kidney of cattle and swine supplied by the Meat Experiment Station in

the City of Sendai in September and October, 1979. In the 20 specimens of phrenic muscle from cattle α-BHC was not detected, but β-BHC was detected at the rate of 45%, and at an average concentration of 0.001 ppm. DDE was detected at very low levels. In the 20 specimens of adipose tissue from cattle, α-BHC was not detected. β-BHC was detected at the rate of 45%, and at an average content of 0.012 ppm. DDE was detected at the rate of 60% and at a concentration of 0.002 ppm. In the 20 muscle specimens from swine, β-BHC and DDE were detected at low concentrations. In the 20 specimens of adipose tissue from swine, β-BHC was detected only once; DDE was detected at a rate of 80%, at a concentration of 0.002 ppm. PCB was not detected in any specimens. BHC, DDT and PCB were not detected in any liver or kidney samples. Although these organochlorine pesticide residues were detected at a high concentration in beef, pork and internal organs in 1971, the concentration was gradually reduced from 1975 to 1978.

81-2499. Leistra, M.; Smelt, J. H. (Inst. Pestic. Res., NL-6709 PG Wageningen, The Netherlands) **Movement and conversion of ethoprophos in soil in winter. 2. Computer simulation.** *Soil Sci.* 131(5): 296-302; 1981 (12 references).

A computer simulation model was used to describe water flow in soil columns and water balance in the field in winter. Three soil batches used in the adsorption measurements were collected from the plough layer. The conversion rate of ethoprophos (ethoprop) under field conditions in the winter of 1978-1979 was first simulated separately with a small computer model. A separate series of computer simulations was made on water flow in the 3 soils sampled. The averaged adsorption coefficients of ethoprop were 0.68 dm^3/kg for silt loam, 0.77 dm^3/kg for sandy loam, and 3.43 dm^3/kg for humous loamy sand. The effect of the comparatively high organic matter content of the humous loamy sand soil is evident. Faster conversion of the pesticide occurred in the field than had been predicted by laboratory data. The sequence in conversion rates for the soils was the same in the laboratory and in the field. In the 2 loam soils, simulated conversion clearly continued at temperatures around 0°C, whereas in the humic loamy sand, conversion at this temperature was nearly 0. During the coldest time the remaining amounts were computed to be reduced by 27, 15, and 1.2% in the silt loam, sandy loam, and humous loamy sand, respectively. An acceleration of conversion was also noted with increased soil temperatures in the spring.

81-2500. Rao Kovvali, S. S.; Ghosh, S.; Jayanthi, A. V. (Integr. Res. Cent., ITC Ltd., Peenya, Bangalore, India) **Chlorinated pesticide residues on flue-cured tobaccos grown in Andhra Pradesh.** *Tobacco Res.* 6(1): 49-56; 1980 (11 references).

Analyses of tobacco samples indicated the presence of chlorinated pesticide residues. Composite tobacco samples, grown in various regions of Andhra Pradesh, India, in 1975, 1976, and 1977 were extracted with aqueous acetonitrile and partitioned with hexane. Following Florisil clean-up, samples were analyzed by gas chromatography. The levels of each pesticide varied considerably with the area and soil type in which the tobacco was grown. Central Belt tobaccos contained the highest DDT residues during all years of the study. An analysis also indicated that the top leaves of the Central Belt plants had the highest pesticide levels, followed by the middle, then the bottom leaves. DDT distribution on plants in all other areas was variable. The residual pattern in the Central Belt may be due to airborne drift from cotton pest control in adjacent fields. Residues of lindane and the other BHC isomers, endrin, dieldrin, and endosulfan, were within the tolerance limits.

81-2501. Copenhaver, E. D.; Wilkinson, B. K. (Toxic Mater. Inf. Cent., Oak Ridge Natl. Lab., Oak Ridge, TN) **Movement of hazardous substances in soil: a bibliography. Volume 2. Pesticides.** *US NTIS PB Rep.* PB80-113,103: 235 pp.; 1979 (2000 references).

This bibliography is intended for use by personnel concerned, wether via research or management, with the disposal of hazardous wastes, other than sewage sludge, on land. It is the result of a search of recent literature (1970-1974) and includes information on the transport, transformation, and soil retention of arsenic, asbestous, beryllium, cadmium, chromium, cooper, cyanide, lead, mercury, selenium, zinc, halogenated hydrocarbons, pesticides, and other hazardous substances. About half of the 2000 entries include an abstract. In order to limit the size of the resulting publication, the literature search focused on processes directly related to transport (adsorption, ion exchange, etc) and documentation of the occurrence and extent of transport, while specifically excluding topics such as uptake and translocation by plants, modeling, and effects on microorganisms and processes mediated by microorganisms. The bibliography has been divided into 2 volumes to facilitate its use: Volume 1 contains all the substances studied except pesticides; Volume 2 contains the pesticide citations. (Author abstract by permission)

81-2502. Baratov, K. B.; Redler, I. O.; Danilova, R. V.; Usmanov, U. M.; Makhmudov, D. M.; Rasulov, A.; Ergashev, A. E.; Osmanov, U. (Tadzhik Res. Inst. Epidemiol. & Hyg., USSR) **Zavisimost' soderzhaniya nekotorykh mikroelementov v vinograde i abrikosakh ot vida, dozirovki gerbitsidov. [Relationship between the type and dose of herbicide and the content of certain trace elements in grapes and apricots.]** *Vopr. Pitan.* (2): 66-68; 1981 (6 references) (Russian).

The effect of increased doses of the herbicides dalapon (8, 10, and 12 kg/ha) and prometryne (7 and 9 kg/ha) on the content of certain trace elements in grapes

was studied. None of grape and apricot samples contained prometryne residues. Dalapon levels ranged from 0.13 to 0.43 mg/kg. Prometryne and dalapon increased accumulation of iron, titanium, nickel, and molybdenum in grapes, but did not increase manganese content. Treatment of apricot trees with the herbicide phosalone (0.2%) also increased the content of trace elements.

81-2503. Laplanche, A.; Bouvet, M.; Venien, F.; Martin, G.; Chabrolles, A. (Ec. Nat. Super. Chim. Rennes, Lab. Chim. Eaux & Environ., Rennes, Beauleiu, France) **Modelisation de l'evolution du parathion dans le milieu naturel sur un pilote de laboratoire. [Modelling parathion changes in the natural environment laboratory experiment.]** *Water Res.* 15(5): 599-607; 1981 (36 references) (French).

A laboratory pilot plant was used to study the fate of parathion in a river, and its degradation by hydrolysis, photochemical oxidation, biological transformations, and retention by sludge and sediments. The experimental period was 55 days. The plant was fed with a solution containing 13 mg/l parathion for the first 34 days. During the following 21 days, the effluent was continuously recycled. Biological degradation of the pesticide to nonpoisonous aminoparathion and its adsorption by sediments was monitored. The quantity of parathion reduced was proportional to the amount of ATP found in the activated sludge tank. The shock effect of parathion on a bacterial population was studied by varying the organophosphorus concentration and the amount of volatile suspended solid. The microorganisms were not affected by the poison, and reduction to aminoparathion was noted. However, a very large dose of parathion, such as 1 mg/l, destroyed the living organisms. The presence of an anionic or cationic surfactant played no part in the toxicity of parathion but totally inhibited the degradation of parathion.

81-2504. Kilz, C.; Scharf, R. (Bezirkshygieneinspektion & Inst. Cottbus, Insp. Kommunalhyg., Abt. Wasserhyg., DDR-7500 Cottbus, DDR) **Untersuchungen uber die Eindringtiefe von chlorierten Kohlenwasserstoffinsektiziden in den Boden von Intensivobstbaugebieten. [Tests to determine the depth of penetration of chlorinated hydrocarbon insecticides in the soil of intensive fruit cultivation areas.]** *Z. Gesamte Hyg. Ihre Grenzgeb.* 27(3): 225-228; 1981 (7 references) (German).

DDT and lindane residue levels were investigated in sandy loam soil samples and in crude water samples in a fruit-growing area located in water catchment and protected zones for drinking-water supply. DDT, its metabolites, and lindane were detected in all topsoil samples and in most samples from the 10-40 cm layers. The DDT, DDD (TDE), and DDE levels decreased markedly below 40 cm, and were not detectable at 100 cm depth. Lindane was detectable even at 100 cm. No DDT, DDE, DDD, or lindane residues were detectable in crude water samples from deep wells.

See also 81-2408, 81-2412, 81-2421, 81-2427, 81-2437, 81-2439, 81-2506, 81-2507, 81-2508, 81-2511, 81-2516, 81-2518, 81-2520, 81-2526, 81-2531, 81-2532, 81-2533, 81-2582, 81-2587, 81-2632, 81-2676, 81-2683, 81-2690, 81-2692, 81-2693, 81-2694 *and* 81-2698.

81-2505. Howard, J. K.; Sabapathy, N. N.; Whitehead, P. A. (Chem. Ind. Assoc., London, England) **A study of the health of Malaysian plantation workers with particular reference to paraquat spraymen.** *Br. J. Ind. Med.* 38(2): 110-116; 1981 (19 references).

Pulmonary function tests, renal function, liver function, and a full hematological screen were performed on 27 paraquat spraymen, and on members of 2 control groups. One of the control groups was composed of 24 general plantation workers with minimal exposure to paraquat arising from occasional work in recently sprayed areas. The second control group consisted of 23 latex factory workers with no known occupational exposure to paraquat. The spraymen had a mean spraying time of 5.3 yr with a mean individual annual quantity of paraquat handled of 67.2 kg as paraquat ion. Eleven spraymen complained of 1 or more incidents of skin irritation or rashes associated with spraying, being most common on the hand, legs, or groin. No significant differences were found in respiratory or hematological indices for exposed or control groups. Smoking was not a significant variable. The overall data indicate that long-term spraying does not carry with it associated health risks, in spite of the large quantities of paraquat used.

81-2506. Davies, J. E.; Levine, R. S.; Fordyce, M. (Dep. Epidemiol. & Public Health, Sch. Med., Univ. Miami, Miami, FL 33101) **Pollution and people: need for selective monitoring.** *Br. Med. J.* 282(6281): 2054; 1981 (4 references).

This letter to the editor raises the point that blacks may be particularly at risk to DDT pollution. This chemical is the major human pesticide pollutant in adipose and serological pesticide surveys throughout the world. Several surveys of multiracial populations have shown that total DDT residues are almost twice as high in blacks as in whites, and that this difference cannot be totally explained on the basis of social class. Two surveys have indicated that among black populations, DDT levels continue to increase with age beyond the DDT age of the population. A study of the 24-hr urinary excretion of 6β-hydroxycortisol in children occupationally exposed to DDT through agricultural work demonstrated significant differences in excretion levels among black children. A positive correlation was also noted of total serum DDT levels with serum triglyceride levels in 24 Haitian immigrants recently arriving in Florida.

81-2507. Stevens, E. R.; Davis, J. E. (Wenatche Pestic. Res. Branch, US EPA, Wenatchee, WA 98801) **Potential exposure of workers during seed potato treatment with captan.** *Bull. Environ. Contam. Toxicol.* 26(5): 681-688; 1981 (5 references).

A study was designed to evaluate the potential for exposure to captan of workers involved in potato planting. Captan is currently under re-evaluation by the EPA. Respiratory exposure was measured using gauze-faced pads in modified dust respirators, and dermal exposure by gauze pads attached to shoulders, back, and chest. An alcohol rinse technique was used to measure hand exposures. Exposure periods between hand rinses and between changes of monitoring media averaged 1 hr. Exposed pads were extracted with toluene, and captan residues were quantified by gas chromatography using an electron capture detector. Total dermal exposures ranged from 0.33 mg/hr, for an observer riding on the rear of the planter, to 15 mg/hr for a worker filling a seed potato duster outside (using rocky seed). Respiratory exposures ranged from 0.027 mg/hr for an observer riding on the rear of the planter to 1.7 mg/hr for a worker filling a duster outside (rocky seed). These data confirm results from previous studies that indicate that the inhaled dust formulations result in a relatively high percentage of total exposure. Disposable dust respirators might essentially eliminate the potential problem.

81-2508. Anonymous **EPA ordering review of last chlordane use.** *Chem. Mark. Rep.* 219(21): 5, 32; 1981.

EPA has initiated new reviews of the antitermite pesticides heptachlor, dieldrin, aldrin, lindane, pentachlorophenol (PCP) and chlordane. The review of chlordane was called due to evidence that it was migrating from the soil under slab construction houses and from plenum areas into air ducts for heating and cooling homes. Examples were cited in military housing at Wright-Patterson and Scott Air Force bases in Dayton (OH) and in Bellview (IL). Existing studies conflict in their estimates of chlordane toxicity. An epidemiological study conducted by Velsicol found no evidence of any long-term latent health effect related to employment (up to 28 yr) at a plant manufacturing chlorinated hydrocarbon insecticides. These findings suggest there is apparently no practical risk of cancer to humans from heptachlor.

81-2509. Anonymous **Reagan aides mull pesticide standard.** *Chem. Week* 128(13): 26; 1981.

A discussion of changes in pesticide-related standards proposed by Reagan aides is presented. Of primary concern is the genetic safety standard for pesticide production and formulation proposed by the Carter administration. The pesticide industry discouraged this standard because it would call for standardization of protective clothing in spite of the fact that pesticides exhibit different degrees of toxicity. Supporters of the standard point out the many hazards of exposure to pesticides and emphasize the need for protection of persons handling them. The author suggests that it is unreasonable to set standards for the pesticide industry alone, that the standards should apply to the whole chemical industry.

81-2510. Lee, W. R.; Sega, G. A.; Skinner, P. S.; Sabourin, J. R. (Louisana State Univ., Baton Rouge, LA 70803) **Risk estimation for exposure of humans to ethylene dibromide.** *Environ. Mutagenesis* 3(3): 374-375; 1981.

A description is presented of the use of molecular dosimetry to factor a risk estimation equation for exposure of humans to ethylene dibromide. The necessary data presented include the relation between exposure and dose to the germ cells as determined in a mammal (mouse); the relation between dose to the germ cells and mitotic frequency as determined in a well-developed test system for mutations (*Drosophila*); and human health effects. From the data presented it is estimated that a 10-yr occupational exposure (40 mg/kg/yr) before reproduction would induce a 7% increase in major genetic diseases in the first generation. [Presented at the 12th annu. meet. of the Environ. Mutagen Soc.]

81-2511. Matanoski, G. M.; Landau, E.; Tonascia, J.; Lazar, C.; Elliott, E. A.; McEnroe, W.; King, K. (Sch. Hyg. & Public Health, Johns Hopkins Univ., Baltimore, MD 21205) **Cancer mortality in an industrial area of Baltimore.** *Environ. Res.* 25(1): 8-28; 1981 (6 references).

An excess mortality from lung cancer has been demonstrated among men living in the highly industrialized area of South Baltimore over the period 1966-1974. The death rate is significantly higher than in control tracts in the later years. In the area surrounding a pesticide plant, high levels of arsenic were found in the soil. This area corresponds generally to the area in which a high proportion of lung cancers occurred. No attempt was made to directly correlate arsenic levels to residences of lung cancer deaths. Hospital records did not suggest that the increase in lung cancer was related to a change in diagnostic practices, cell types, or other factors. It is noted, however, that the excess risk appeared to occur primarily in the late 1960s and early 1970s. The relationship of this excess risk to the pesticide plant is questioned; the plant had been in existence on this site since the early 1900s. It is suggested that the sudden increase in risk may be related to the destruction of the old plant in 1952; this demolition could have spread dust diffusely throughout the community.

81-2512. Eliseev, Yu. Yu. (Med. Inst., Saratov, USSR) **Gigienicheskaya kharakteristika produktov transformatsii fosfororganicheskikh yadokhimikatov, obrazuyutsikhsya v protsesse obrabotki body okislitelyami. [Hygienic characteristics of products of organophosphorus pesticide transformation formed during treatment of water with oxidants.]** *Gig. Sanit.* 46(5): 79-80; 1981 (6 references) (Russian).

The effect of oxidizing agents used for water purification on organophosphorus pesticides (OPP) and their transformation products was studied. Treatment of water with strong chlorine-containing oxidants provided a 51.4-98.0% degradation of OPP, but enhanced the specific odor of OPP. Potassium permanganate improved the organoleptic properties of the water, but did not reduce the toxicity of OPP. Ozonation of the water reduced the toxicity and odor of chlorinated OPP. These findings indicate that only combined used of chlorine-containing oxidants, potassium permanganate, and ozone can provide hygienic improvement of drinking water.

81-2513. Rakitskii, V. N. (All-Union Res. Inst. Hyg. & Toxicol. Pestic. Polym. & Plast., Kiev, USSR) **Otsenka stepeni real'noi opasnosti razvitiya ostrykh ingalyatsionnykh otravlenii pri primenenii pestitsidov. [Estimation of the risk of development of acute inhalation poisoning after pesticide application.]** *Gig. Sanit.* 46(5): 81-82; 1981 (7 references) (Russian).

Improvement of the existing criteria and classifications of the risk of acute inhalation poisoning after exposure to pesticides is suggested. A coefficient of real danger of the development of acute nonlethal poisoning ($CRD_{inh\text{-}ac}$) is presented. The coefficient is defined as the ratio of the maximum detectable pesticide concentration in the air (mg/m³) to the threshold concentration for the most sensitive animal species after a single 4-hr exposure (Lim_{ac}). The calculated values of $CRD_{inh\text{-}ac}$ for hexachlorobenzene, metaphos (methyl parathion), chlorophos (trichlorfon), and cyanamide (calcium cyanamide) were 1180x, 78.6x, 54.5x, and 24.2x, respectively, greater than the corresponding values of the coefficient of the potential danger of acute inhalation poisoning.

81-2514. Katsenovich, L. A.; Ruzybakiev, R. M.; Fedorina, L. A. (Med. Inst., Tashkent, USSR) **T- i V-sistemy immuniteta u bol'nykh s intoksikatsiei pestitsidami. [T- and B-immunity in patients with pesticide poisoning.]** *Gig. Tr. Prof. Zabol.* (4): 17-19; 1981 (7 references) (Russian).

T- and B-immunity were studied in patients with pesticide poisoning. All patients had experienced occupational exposure to a number of organochlorine and organophosphorus pesticides. Duration of exposure ranged from 5 to 15 yr. The patients were divided into 3 groups: group 1 showed few clinical symptoms (premorbid phase of poisoning), group 2 showed symptoms of chronic poisoning, and group 3 showed long-term symptoms of poisoning. Pesticide poisoning caused significant inhibition of T-immunity (decrease of the number of rosette-forming T-lymphocytes and inhibition of their functional activity), and simultaneous stimulation of B-immunity (increased number of rosette-forming B-lymphocytes and increased levels of IgG and IgA). These changes were the most pronounced in group 2.

81-2515. HMSO (Baynards House, London W2 4TF, England) **Biological monitoring of workers exposed to**

organophosphorus pesticides. *Guidance Note: Med. Ser.* 17: 1-4; 1981.

The majority of work-related exposures to organophosphorus compounds occur during manufacturing and packaging operations; transport, storage and distributing operations; application and use of the chemicals; and contact with contaminated containers as in scrap recovery. Organophosphate (OP) contamination may occur via the skin, respiratory tract, or eyes. Ingestion is rare unless intentional. Toxic effects in humans are usually a result of inhibition of cholinesterase enzymes, mainly acetylcholinesterase (AChE) and plasma cholinesterase. The 2 major sites for OP toxicity are the blood and the nervous system. Clinical manifestations of poisoning include headaches, giddiness, loss of appetite, nausea, tremors and impaired coordination, miosis, blurred vision, excessive salivation and sweating, increased bronchial gland secretion, slowed heart rate with decreased cardiac output and hypotension, running eyes and nose, urinary incontinence, abdominal pain, vomiting and broncho-constriction, and depression of the brain stem respiratory center. The degree of inhibition of blood cholinesterase activity can be used as an objective index of OP AChE poisoning. Regular health surveillance is suggested for those individuals who come into contact with OP compounds on a regular basis. An effective program would include the measurement of both whole blood AChE and plasma cholinesterase activities, determination of pre-exposure base lines, and testing of blood samples at periodic intervals during the period of occupational exposure. Advantages and disadvantages of electrophysiological monitoring are briefly noted.

81-2516. Ziglio, G.; Giovanardi, A. (Ist. Ig., Univ. Studi Milano, Milan, Italy) **Contaminazione delle acque potabili da composti cloro-organici: origine, effetti biologici, misure di protezione e di controllo. [Drinking water contamination with chloro-organic compounds: sources, health effects, control.]** *Ig. Mod.* 75(4): 395-426; 1981 (66 references) (Italian).

Frequent contamination of Italian drinking water with organochlorine compounds was noted, particularly in the city of Milan. These pollutants reach the water supply from industrial manufacturers, chemical industries, and from their use as agricultural agents. Other organochlorine compounds are formed during the processes by which drinking water is treated. Some of these compounds are carcinogenic in animals and suspected of being carcinogenic in humans. Monitoring schedules need to be developed to maintain control of drinking water quality. Other suggestions to eliminate the hazards posed by organochlorines are presented. Contaminated wells must be cleaned and uncontaminated water made available.

81-2517. Baumann, K.; Behling, K.; Brassow, H. L.; Stapel, K. (Ordinariat Arbeitsmed., Univ. Hamburg, D-2000 Hamburg 76, BRD) **Occupational exposure to hexachlorocyclohexane. III. Neurophysiological findings and neuromuscular function in chronically exposed workers.** *Int. Arch. Occup. Environ. Health* 48(2): 165-172; 1981 (27 references).

Functions of the nervous system were examined in 60 workers in a production factory making lindane (HCH). No pathological signs were noted in the response of reflexes and sensibility examinations. Mean values of amplitude and frequency of forefinger tremor were found at about 20 μm and 10 Hz, respectively, without significant differences between this group and 2 groups of nonexposed individuals. No pathologic patterns were noted in electromyography. The maximal motor nerve conduction velocity of ulnar nerves showed nearly identical mean values of 59.5 m/s in HCH-workers and controls. Neuromuscular conduction as revealed by distal latencies was not impaired. Electroencephalographic recordings taken in spot-checks of HCH-workers and controls did not show any specific pathological signs. Only small abnormalities in rhythm could be observed in some cases of workers as well as of controls. Even after years or decades of occupational exposure to lindane, no signs of neurological impairment or perturbation of neuromuscular function could be noted.

81-2518. Kreiss, K.; Zack, M. M.; Kimbrough, R. D.; Needham, L. L.; Smrek, A. L.; Jones, B. T. (Chron. Dis. Div., Bur. Epidemiol., CDC, Atlanta, GA) **Association of blood pressure and polychlorinated biphenyl levels.** *J. Am. Med. Assoc.* 245(24): 2505-2509; 1981 (21 references).

A communitywide study was conducted in Triana, Alabama in May in 1979 in which the population was found to have had exceptional exposure to DDT residues resulting from eating locally caught fish. During the analysis of serum specimens for DDT residues, interference from PCBs was noted. PCB levels were later measured in the specimens. A strong positive correlation was noted between log PCB and log DDT levels in 47 catfish taken from the Tennessee River system. The high correlation between ΣDDT and PCB residues in serum specimens from people in the area was explained by the common dietary source (fish) and similar accumulation in the body. Laboratory data demonstrated that residue carry-over of DDT to PCB measurements did not occur. Whether DDT residues affects the toxicity or metabolism of PCBs is not known. For other pairs of chlorinated hydrocarbons, however, it is noted that the excretion of one member of the pair can be reduced or enhanced by the other.

81-2519. Wang, H. H.; Grufferman, S. (Epidemiol. Biostat. Unit, Compr. Cancer Cent., Med. Center, Duke Univ., Durham, NC 27710) **Aplastic anemia and occupational pesticide exposure: a case-control study.** *J. Occup. Med.* 23(5): 364-366; 1981 (19 references).

Sixty-seven deaths due to aplastic anemia between 1968 and 1977 among North Carolina residents were identified from computerized listing. In 7 cases an associated malignancy occurred; these cases were not included in this study. Among the remaining 60 cases, possible employment in farming, landscaping, gardening, or pest exterminating was checked. Of the 60 subjects, 8 had been farmers and landscapers; of 120 controls, 21 had these occupations. None of the occupations showed a significantly higher frequency among the aplastic anemia victims. In spite of several case reports of aplastic anemia following exposure to pesticides, estimates of relative risk suggest that people who are occupationally exposed to pesticides may actually have a lower risk of developing aplastic anemia than those who are not. There appears to be no increased risk of aplastic anemia to people in pesticide exposed occupations.

81-2520. Franklin, C. A.; Fenske, R. A.; Greenhalgh, R.; Mathieu, L.; Denley, H. V.; Leffingwell, J. T.; Spear, R. C. (Environ. Health Direct., Health & Welfare Canada, Ottawa, Ontario, Canada) **Correlation of urinary pesticide metabolite excretion with estimated dermal contact in the course of occupational exposure to Guthion.** *J. Toxicol. Environ. Health* 7(5): 715-731; 1981 (26 references).

Consequences of exposure to Guthion 50 wettable powder (azinphos-methyl) was examined in 17 orchardists, following normal spraying procedures with orchard air blast equipment at the recommended spray schedule of 50-70 gal/acre (467.5-654.5 l/ha) with an application rate of 1.25 lb/acre (11.69 l/ha). The operator was located about 2 m in front of the spray rig nozzles, and ultra-low volume procedures were usually followed. Fourteen participants sprayed for 1 day, 1 for 2 days, and 2 for 3 days; only data for those who sprayed for 1 day were tabulated. Spraying commenced early in the morning and continued as long as wind conditions permitted, from 2.5 to 9 hr. All spraying took place in a 3 wk period. All workers had quantifiable levels of alkyl phosphates after exposure and 24 hr urine samples provided a more reliable estimate than first morning voids. A high correlation was noted between 48 hr alkyl phosphate excretion and the amount of active ingredient sprayed. A fluorescent tracer was added to the tank along with the Guthion. The finding of Guthion on patches beneath the clothing was confirmed by the presence of the tracer on the skin. Rubberized clothing did not appear to be significantly more protective than heavy coveralls. No significant depression was noted in either red blood cell or serum cholinesterase activity in any of the workers.

81-2521. Rothenberg, R. (Author address not given) **Morbidity study at a chemical dump – New York.** *Morbid. & Mortal. Wkly. Rpt.* 30(24): 293-294; 1981 (3 references).

A 1979 morbidity study carried out on persons living or working near a chemical disposal site near Niagara Falls, NY is described. The landfill had been used from 1953 to 1975 as a disposal site for approximately 80,2000 tons of chemical waste, including many chlorinated hydrocarbons. A composted clay cover was installed over the landfill in 1978 following numerous complaints of odors, skin irritation, and metal corrosion. Lindane, mirex, and dioxins were found in ppb levels in dust samples from rafters of 3 companies adjacent to the landfill. When a medical study was carried out on 290 (59%) of the current employees of the 3 adjacent companies and the maintenance workers from a nearby college, no consistent patterns of health effects were observed. Of the 180 evaluated variables, 5% were statistically significant indicators of ill health. There was no effect on miscarriage rate, blood pressure, or other blood parameters, and no evidence of chloracne. Of the 55 participants who had blood lindane and mirex determinations made, none had detectable levels of mirex, and 3 showed 0.05 ppb of lindane. An editorial note points out that the low participation rate limits the interpretation of the study, and that the approach used is not particularly effective in evaluating the effects of relatively low exposures to multiple toxic chemicals.

81-2522. Brownstein, R. (Author address not given) **Who compensates the victims?** *Nation* 230(25): 777-780; 1980.

Government compensation of veterans who were exposed to Agent Orange (a 50-50 mixture of 2,4,5-T and 2,4-D) during the Vietnam War and who have subsequently developed serious health problems or have produced children with serious problems is discussed. Current congressional bills designed to aid victims of atomic-test fallout or uranium exposure in mines will shift the burden of proof from the victim by defining which diseases result from exposure to certain pollutants. However, current legislation designed to aid defoliant-exposed veterans will allow the Veteran's Administration to continue defining which illnesses are related to Agent Orange exposure.

81-2523. Diperna, P. (Author address not given) **The lethal cloud of indifference.** *Nation* 232(25): 786-789; 1981.

Some of the problems associated with exposure of child farm laborers to pesticides are discussed. Little research has been done on this topic, and estimates of the number of child farm laborers are not exact; the amount of exposure is difficult to quantify. Children too young to work are also present in the fields due to the lack of day care centers. Farm workers generally are not advised about the hazards of the pesticides to which they are exposed, and the establishment of re-entry times (safe times to enter fields after spraying) is difficult, especially for children. Children are thought to be especially vulnerable, since poor nourishment may make people more susceptible to toxins.

Rates of absorption of chemicals through the skin are higher among children, and disruption in brain function due to pesticide exposure has been shown to last longer than previously thought. Some symptoms of pesticide poisoning which have been reported in children are described.

81-2524. Lings, S. (Miltonsvej 13, DK-8270 Hojbjerg, Denmark) **Biocidlunge. En undersogelse af frugtaviere i sprojtesaesonen. [Biocide lung. An investigation of fruit growers during the spraying season.]** *Ugeskr. Laeg.* 143(19): 1207-1211; 1981 (8 references) (Danish).

The case of a 52-yr-old fruit grower with large atypical pulmonary infiltration and pulmonary fibrosis is presented. For several years, the man had been using spray formulations containing oxydemeton methyl, diquat, paraquat, benomyl, captafol, captan, azinphos-methyl, parathion, and carbaryl. The case precipitated the investigation of 181 fruit growers during the peak spraying season in 1975. The investigation included an interview, Wright's peak flow test, and chest x-ray. The patients had been exposed to 156 types of spray formulations containing 92 different active agents. Each individual had been exposed to 3-27 active agents. Various symptoms, most frequently pulmonary symptoms and headache, were experienced by 87 (43%) in connection with the spraying. The peak flow was reduced in 33 (19%). Relevant radiographic findings were observed in 43 (24%). The use of a protective mask had no significant effect. The findings suggest that biocides may produce pulmonary disease (biocide lung; pneumonia) recognizable radiographically from round infiltrates and chronic progressive pulmonary fibrosis.

81-2525. Thiele, V. E.; Jastroch, S.; Lange, B. (Lehrstuhl Arbeitshyg., Ernst-Mortiz-Arndt Univ., DDR-2200 Greifswald, DDR) **Analysenergebnisse zum Verteilungsmuster der Pestizidexposition nach den Abteilungen des Giftgestzes bei Werktaetigen der Agrochemischen Zentren. [Results of analysis of distribution patterns of exposure of people working in agrochemical center with reference to the relevant sections of the law on poisonous substances.]** *Z. Gesamte Hyg. Ihre Grenzgeb.* 27(1): 6-8; 1981 (4 references) (German).

The distribution pattern of pesticide exposure of 95 workers at 6 different agrochemical centers in East Germany in 1975, 1976, and 1977 was analyzed. The overall duration of exposure/yr was 653.6 ± 394 hr (684.9 ± 456.9 hr in 1975, 654.9 ± 378.8 hr in 1976, and 608.7 ± 373.6 hr in 1977). The exposure was most extensive in May, followed by June, July, August, September, April, and October. Exposure to preparations subject to the Law on Toxic Substances has decreased from 66.7% to 58.5% during the 3-yr period. Hedolit (DNOC) accounted for 63.5% of the total exposure, followed by Bi 58 EC (dimethoate; 15.5%), Sys 67 ME (MCPA; 10.7%), Regione (diquat; 9.4%), Spritz Hormin (2,4-D; 8.7%), and Melipax (8.5%).

81-2526. Thiele, V. E.; Fieber, C.; Jastroch, S.; Knoll, W.; Lange, B. (Lehrstuhl Arbeitshyg., Bereichs Med., Ernst-Moritz-Arndt Univ., DDR-2200 Greifswald, DDR) **Arbeitsplatzkonzentrationsbestimmungen und Verteilungsmuster der Pestizidexposition nach Stoffgruppen bei Werktaetigen Agrochemischer Zentren. [Determination of toxic concentrations at places of work and patterns of distribution of pesticide exposure of people working at agrochemical centers subdivided by substance groups.]** *Z. Gesamte Hyg. Ihre Grenzgeb.* 27(3): 173-177; 1981 (9 references) (German).

The distribution pattern of pesticide exposure and workplace pesticide concentrations occurring during the preparation of spray liquids were studied at 6 agrochemical centers in East Germany during the period 1973-1979. Triazines accounted for 22.1% of the total exposure, chlorophenoxy acid and aliphatic carboxylic acid derivatives for 22.1%, organophosphates for 10.3%, organochlorines for 5.6%, carbamates for 5.4%, aromatic dinitro compounds for 5.0%, dithiocarbamates for 4.2%, and others for 25.3%. The mean workplace concentrations (in mg/m^3) were as follows: 0.349-0.421 for *p,p*-DDT, 0.055-0.057 for *o,p'*-DDT, 0.016 for DDD, 0.016-0.146 for lindane, 0.0034-0.0063 for α-BHC, 0.0051 for β-BHC, 0.744 for kelevan (ENT 27154), 0.0155 for dimethoate, 0.846 for demephion, 0.081-0.846 for DNOC, 0.088-0.595 for MCPA, and 0.02 for 2,4-D.

81-2527. Thiele, E.; Baufeld, W.; Grimm, U.; Lehnick, B.; Thiele, W. (Lehrstuhl Arbeitshyg., Bereichs Med., Ernst-Moritz-Arndt Univ., DDR-2200 Greifswald, DDR) **Analysenergebnisse zur Ableitung von Expositionszeitlimitierungen fur die arbeitshygienische Uberwachung pestizidexponierter Werktaetiger der ACZ. [Results of analysis for deriving exposure time limits in the industrial hygiene monitoring of people working at agrochemical centers who are exposed to pesticides.]** *Z. Gesamte Hyg. Ihre Grenzgeb.* 27(3): 177-180; 1981 (26 references) (German).

The pattern of exposure of workers at 7 agrochemical centers in East Germany during the period 1975-1978 was analyzed, and yearly exposure time limits were determined by regression analysis. Clinical laboratory test results and the corresponding anamnestic data on the length of exposure were used in this analysis. The overall duration of exposure was 711.2 hr/yr. Average exposures to specific pesticides were as follows: 24.6 hr for aromatic dinitro compounds, 73.2 for organophosphates, 39.6 for organochlorine pesticides, 158 for phenoxycarboxylic acids, 161.9 for triazines, 26.3 for dithiocarbamates, 32.4 for carabamates, and 195.2 for other pesticides. The

laboratory parameters determined were serum albumin level, ornithine-carbamyl transferase, iso-5-lactate dehydrogenase, L-alanine-2-oxyglutarate aminotransferase, serum cholinesterase activities, and the thymol turbidity test. The yearly exposure limits, above which pathological changes were observed regularly, were found to be 40 hr/yr for aromatic dinitro compounds, 38 hr/yr for organophosphates, 178 hr/yr for phenoxycarboxylic acids, 182 hr/yr for triazines, 40 hr/yr for dithiocarbamates, and 54 hr/yr for carbamates.

See also 81-2412, 81-2413, 81-2417, 81-2420, 81-2421, 81-2439, 81-2443, 81-2486, 81-2565, 81-2610, 81-2612, 81-2619, 81-2638 *and* 81-2684.

81-2528. Izaki, K.; Takahashi, M.; Sato, Y.; Sasagawa, Y.; Sato, K.; Furusaka, C. (Dep. Agric. Chem., Fac. Agric., Tohoku Univ., Sendai 980, Japan) **Some properties of pentachlorophenol- resistant gram-negative bacteria.** *Agric. Biol. Chem.* 45(3): 765-767; 1981 (9 references).

Results of tests to determine the levels of pentachlorophenol (PCP) resistance in rice paddy bacteria are reported. Data obtained from liquid culture methods indicate that strains belonging to the genus *Pseudomonas* are generally highly resistant; strains of *Salmonella, Enterobacter,* and *Escherichia* were moderately resistant; and strains of *Bacillus, Flavobacterium, Streptomyces, Staphlococcus,* and *Corynebacterium* were very sensitive to PCP. Gram-negative bacteria were generally more resistant than gram-positive bacteria. In tests of the degradation of PCP by these strains, it was seen that there was no correlation between the levels of resistance and PCP degradation. For example, *Pseudomonas* (highly resistant) degraded only 4-8% of the added PCP in 24 hr, while *Bacillus* (highly sensitive) degraded 70-90% of the added PCP. Resistance to PCP is not explained by degradation of PCP, and data presented indicate that lipopolysaccharide or outer membrane is an important barrier for PCP and contributes to the resistance of gram-negative bacteria to PCP.

81-2529. Komura, T.; Nagayama, H. (Sendai Shirayuri Junior Coll., Izumi, Miyagi 981-31, Japan) ***In vitro* stimulation by parathion of porcine pancreatic carboxylesterase activity toward triacetin.** *Agric. Biol. Chem.* 45(4): 1019-1020; 1981 (10 references).

In vitro studies have demonstrated that phytol stimulates the carboxylesterase (TA-esterase) activity toward triacetin in true solution in crude porcine pancreatic lipase preparation. In spite of the marked structural differences between parathion and phytol, the stimulation of TA-esterase activity by parathion and the parathion concentration that produces maximal activator activity were almost identical to those observed with phytol. Parathion when added with phytol, did not increase stimulation beyond that observed in the phytol alone. This observation suggests that stimulation by parathion and phytol may involve the same mechanism. Parathion also inhibited the esterase activity significantly (35-50%) when methyl butyrate and *p*-nitrophenyl acetate were used as substrate instead of triacetin. Parathion probably binds to the amino acid residues other than serine in the enzyme molecule. It is suggested that the stimulation of TA-esterase activity by parathion may be due to the result of the modification of the enzyme.

81-2530. VanHolder, R.; Colardyn, F.; De Reuck, J.; Praet, M.; Lameire, N.; Ringoir, S. (Renal Div., Dep. Med., Univ. Hosp., Gent, Belgium) **Diquat intoxication. Report of two cases and review of the literature.** *Am. J. Med.* 70(6): 1267-1271; 1981 (23 references).

Two cases of diquat poisoning are reviewed. In the first case a 16-yr-old girl ingested 50 ml of Reglone (diquat 20 g/100 ml) in a suicide attempt. The second case involved a 60-yr-old woman who ingested 20 ml of Reglone. In the first patient, no treatment other than gastric lavage was given due to the satisfactory general condition. The second patient also appeared in satisfactory clinical condition and was given no specific therapy. The first patient displayed progressive oliguria and coma developed a few hr after admission; death occurred 24 hr after ingestion of the poison. The second patient developed progressive renal failure 50 hr after admission. After gastric lavage, Fuller's earth was instilled into the stomach. During and after hemoperfusion the patient became progressively comatose; she died from uncorrectable ventricular arrhythmia 5 days after ingestion of diquat.

81-2531. Heckman, C. W. (Inst. Hydrobiol. & Fischereiwiss., Univ. Hamburg, BRD) **Long-term effects of intensive pesticide applications on the aquatic community in orchard drainage ditches near Hamburg, Germany.** *Arch. Environ. Contam. Toxicol.* 10(4): 393-426; 1981 (41 references).

The results of an ecological investigation carried out to determine the structure of an aquatic community in orchard drainage ditches were compared with the results of a similar study conducted about 25 yr earlier, before the full impact of modern pesticides had been felt. Comparisons of the community structures and abundances of the various species indicate that many species have become completely resistant to the agricultural chemicals to which they are exposed, while others have been completely eliminated from the habitat. Certain species have apparently benefitted from the disappearance of predators and competitors and are now present in great abundance. Herbicides have had little, if any, effect on the floral species diversity. Insecticides have taken the greatest toll on predatory species, while acaricidal compounds have completely eliminated all species of water mite. Only one predatory eugamasid mite species was found in the ditches among a large population of collembolans on the water's surface. The individual substances now used in the largest amounts to protect the orchards are discussed, and their properties are listed. The simultaneous use of several toxic substances seems to make the development of resistance more difficult because the probability that one individual will be naturally insensitive to 2 toxic substances is much less than that it will be resistant to 1. The sequential application of different pesticides, on the other hand, allows species to develop populations resistant to each, in turn. (Author abstract by permission)

81-2532. Newell, S. Y. (Mar. Inst., Univ. Georgia, Sapelo Island, GA 31327) **Acute impact of an organophosphorus insecticide on microbes and small in-**

vertebrates of a mangrove estuary. *Arch. Environ. Contam. Toxicol.* 10(4): 427-435; 1981 (52 references).

The effects of 24-72 hr exposure to fenthion (10^1-10^3 ppb) were determined for a fungal community, nitrogen-fixing microbes, and representative meiofaunal and zooplankton invertebrates of a mangrove ecosystem. Also tested were the abilities of a benthic diatom and of fungi to grow in the presence of fenthion. Acute lethal, growth-inhibiting, or process-disrupting effects were not detected for exposures to < 500 ppb fenthion. Results are compared with the findings of several other investigations of the impact of fenthion and other organophosphorus insecticides on non-target organisms. (Author abstract by permission)

81-2533. Greaves, M. P.; Davies, H. A.; Marsh, J. A. P.; Wingfield, G. I. (Agric. Res. Counc., Weed Res. Organ., Begbroke Hill, Yarnton, Oxford OX5 1PF, England) **Effects of pesticides on soil microflora using dalapon as an example.** *Arch. Environ. Contam. Toxicol.* 10(4): 437-449; 1981 (27 references).

Effects of the herbicide dalapon on the soil microflora are evaluated. Measurements were made on populations and pure cultures of micro-organisms, dehydrogenase and phosphatase, soil respiration, and nitrogen transformations. At normal concentrations of 2.6 and 26 ppm, dalapon had little effect and is unlikely to harm the soil microflora or soil fertility. At abnormal concentrations of 266 and 2660 ppm, marked effects occurred on the microflora and its activities. In one soil, 2660 ppm dalapon significantly increased production of ammonium-nitrogen; nitrification was almost totally inhibited in this soil. The results are discussed in terms of the validity of the tests for detecting effects of pesticides on the soil microflora. Some problems, particularly of data interpretation and evaluation, are high-lighted. (Author abstract by permission)

81-2534. Mitjavila, S.; Carrera, G.; Boigegrain, R. A.; Derache, R. (Inst. Natl. Sante & Rech. Med., Inst. Physiol., F-31400 Toulouse, France) **I. Evaluation of the toxic risk of DDT in the rat: during accumulation.** *Arch. Environ. Contam. Toxicol.* 10(4): 459-469; 1981 (43 references).

An investigation was undertaken on the accumulation of DDT and its metabolites in the rat. Rats received 14.5 mg DDT/kg body wt every day for 52 days. Growth, food intake, body composition, and the activities of various enzymes were little affected. However, the level of total lipids fell 30% and the weight of the liver rose 20% due to cellular hypertrophy induced by the DDT. The quantity of DDT and its metabolites found in the carcass was 24 mg/rat; 3 times that found in rats dead after a single dose of 200 mg/kg. Liver and brain contained 130 μg/rat and 10 μg/rat, respectively; 5 times lower than those found in the rats which died from an acute dose of DDT. In the carcass, *p,p'*-DDT accumulates more than *p,p'*-DDT or *p,p'*-DDD (TDE); the latter is preponderant in the liver. (Author abstract by permission)

81-2535. Mitjavila, S.; Carrera, G.; Fernandez, Y. (Inst. Natl. Sante & Rech. Med., Inst., Physiol., F-31400 Toulouse, France) **II. Evaluation of the toxic risk of accumulated DDT in the rat: during fat mobilization.** *Arch. Environ. Contam. Toxicol.* 10(4): 471-481; 1981 (33 references).

The effects of greatly reduced food intake were investigated in rats which had accumulated 3 times as much DDT as rats killed with a single dose approaching LD50. DDT and its metabolites mobilized more quickly than the fat deposits. The hypertrophy of the liver due to DDT decreased during food restriction and demonstrated the existence of a large detoxication capacity shown through the high metabolism of the pesticide. The disappearance of *p,p'*-DDE was most rapid, followed by *p,p'*-DDD and then *p,p'*-DDT; they did not accumulate in the fat reserves. The half-life of the pesticide, which is normally 3 mo in the rat, was reduced to 5 days under the experimental conditions. In spite of rapid mobilization, no major toxic signs were detected from either nutritional, physiopathological, or biochemical examinations. (Author abstract by permission)

81-2536. Mount, M. E.; Oehme, F. W.* (Comp. Toxicol. Lab., Kansas State Univ., Manhattan, KS 66506) **Diagnostic criteria for carbaryl poisoning in sheep.** *Arch. Environ. Contam. Toxicol.* 10(4): 483-495; 1981 (31 references).

Sheep were used to study the effect of carbaryl in liver, heart, and brain and on cholinesterase activity. Carbaryl residues ⩾ 0.01 ppm in the brain were present in all sheep dying after dosing. Sheep dying acutely had higher levels of carbaryl and ⩾ 50% inhibition of brain cholinesterase activity, while sheep with prolonged death had lower carbaryl levels and less cholinesterase inhibition. Prolonged deaths were associated with pulmonary embarrassment, enteritis, hyperthermia, and metabolic acidosis. Carbaryl was rapidly degraded in stored blood samples but was stable in dead brain tissue. (Author abstract by permission)

81-2537. Whitten, M. J.; Dearn, J. M.; McKenzie, J. A. (Dep. Genet., Univ. Melbourne, Parkville, Victoria 3052, Australia) **Field studies on insecticide resistance in the Australian sheep blowfly, *Lucilia cuprina*.** *Aust. J. Biol. Sci.* 33(6): 725-735; 1980 (13 references).

Studies were conducted to assess insecticide resistance in sheep blowfly. Eggs and larvae were collected

from sheep which had been treated with dieldrin and from control sheep not treated. The frequencies of the genotypes and phenotypes for dieldrin resistance (determined by the *Rdl* locus) indicate that selection operates during larval development on sheep with dieldrin residues in the wool. The evolution of insecticide resistance in the blowfly *Lucilia cuprina* in sheep is discussed.

81-2538. Barranco, J.; Darszon, A.; Gomez-Puyou, A. (Dep. Bioquim., Cent. Invest. & Estud. Avanzados, Mexico, DF, Mexico) **Extraction of mitochondrial protein-lipid complexes into organic solvents: inhibition of cytochrome oxidase electron transport by dicyclohexylcarbodiimide and triphenyltin chloride.** *Biochem. Biophys. Res. Commun.* 100(3): 1402-1408; 1981 (16 references).

A procedure to extract directly from mitochondrial membranes cytochrome oxidase as a protein lipid complex into hexane and ethyl ether in a functional state is described. Upon evaporation of the solvent, the residue can be used to form liposomes that display cytochrome oxidase activity. This activity can be inhibited in the liposomes and in the mitochondrial membranes by dicyclohexylcarbodiimide and triphenyltin chloride, (fentin chloride), provided a high inhibitor/cytochrome oxidase ratio is employed. It would appear that the binding of one mol of dicyclohexylcarbodiimide chloride oxidase inhibits proton translocation, whilst the binding of at least 2 mol inhibits electron transport. (Author abstract by permission)

81-2539. Ortiz de Montellano, P. R.; Mathews, J. M. (Dep. Pharm. Chem., Univ. California, San Francisco, CA 94143) **Inactivation of hepatic cytochrome P-450 by a 1,2,3-benzothiadiazole insecticide synergist.** *Biochem. Pharmacol.* 30(10): 1138-1141; 1981 (31 references).

The livers of phenobarbital-pretreated male Sprague-Dawley rats were perfused, removed, homogenized, and extracted. Thin-layer chromatography provided no evidence for the presence of green red-fluorescing pigments analogous to those isolated in other instances. Serum from phenobarbital-pretreated rats decapitated 24 hr after ip injection of the insecticide synergist 5,6-dichloro-1,2, 3-benzothiadiazole (DCBT; 100 mg/kg) was analyzed for SGOT and SGPT transaminase activities. The mutagenicity of DCBT was evaluated using slant cultures of 10 tester bacterial strains. Incubation of hepatic microsomes from phenobarbital pretreated rats with DCBT resulted in rapid, spectroscopically measurable loss of cytochrome P-450. Parallel quantitation of cytochrome P-450 and heme losses due to incubation of DCBT with hepatic microsomes revealed a similar 1:1 relationship between the disappearance of the enzyme and of prosthetic heme. An intimate, causal link between the 2 processes is thus implied. The results reported clearly demonstrate that oxidative turnover of DCBT by cytochrome P-450 results in irreversible inactivation of the enzyme and a parallel loss of microsomal heme. However, the nature of the interaction that causes both enzyme and heme loss cannot be defined precisely.

81-2540. Cook, W. L.; Fiedler, D.; Bourquin, A. W. (Dep. Biol., Georgia State Univ., Atlanta, GA) **Succession of microfungi in estuarine microcosms perturbed by carbaryl, methyl parathion and pentachlorophenol.** *Bot. Mar.* 23(2): 129-131; 1980 (3 references).

Changes in the microfungal populations in 2 different microcosms established from a salt water estuary were monitored on exposure to pentachlorophenol (PCP) at 140 μm/l, carbaryl at 214 g/l and methyl parathion at 75 g/l. Prevalent fungi in the water samples from Range Point varied during the study, but *Trichoderma* was the most common fungus isolated from 10 of 13 sediment samples. A variety of fungi were isolated from the headbox waters. Addition of xenobiotics altered the pattern of species recovered. The prevalent fungus in the sediment of the carbaryl microcosm changed from *Trichoderma* to a *Fusarium* species. In the methyl parathion growth vessel, *Trichoderma* predominated initially but was succeeded by a *Penicillium* species; *Penicillium* I. *Penicillium* II was predominant in the sediment of the pentachlorophenol sediment-water test system. Small amounts of carbon dioxide were released from the xenobiotic molecules by fungi selected from the microcosms.

81-2541. Schultz, D. P.; Harman, P. D. (Southeast. Fish Control Lab., US Fish & Wildl. Serv., Warm Springs, GA 31830) **Effects of fishery chemicals on the *in vitro* activity of glucose-6-phosphate dehydrogenase.** *Bull. Environ. Contam. Toxicol.* 25(2): 203-207; 1980 (10 references).

The *in vitro* activity of glucose-6-phosphate dehydrogenase (G6PDH) was used to assess the toxicity of a variety of chemicals used in fishery activities. Test chemicals included Hyamine 3500, Hyamine 1622, potassium permanganate, and rotenone. Substrate, enzyme, and test chemicals (at 4 different concentrations) were incubated at 27°C until the enzyme substrate reaction was complete, as indicted by a color change. Potassium permanganate was the most inhibitory (31% inhibition at 0.075 mg/l). However, there were no correlations between inhibition by any test compound and the LC50 for trout for that compound. It is concluded that the *in vitro* inhibition of G6PDH cannot be used to predict the toxicity of a chemical to aquatic organisms.

81-2542. Phipps, G. L.; Holcombe, G. W.; Fiandt, J. T. (Environ. Res. Lab., US EPA, Duluth, MN 55804) **Acute toxicity of phenol and substituted phenols to the fathead minnow.** *Bull. Environ. Contam. Toxicol.* 26(5): 585-593; 1981 (15 references).

Toxicity studies with flow-through acute bioassay techniques were conducted to determine the effects of phenolic compounds on the fathead minnow in Lake Superior water. The most toxic compound tested was pentachlorophenol (PCP; 96-hr LC50 = 0.22 mg/l). The least toxic was 3-methoxyphenol (96-hr LC50 = 76 mg/l). Halophenol LC50 values ranged from 6.6 to 12 mg/l (2,4,6-tribromophenol and 2-chlorophenol, respectively). Two nitrophenols tested had 96-hr LC50 values of 61 mg/l (4-nitrophenol) and 17 mg/l (2,4-dinitrophenol) . Two isomers of dimethylphenol had different toxicities. The 96-hr LC50 of 2,4-dimethylphenol was 17 mg/l. With 2,6-dimethylphenol, a 96-hr LC50 could not be attained, even at a high concentration of 27 mg/l. The test conditions were kept uniform, so the results indicate differences in the toxicity of the compounds and not differences in test conditions.

81-2543. Owen, J. W.; Rosso, S. W. (Dep. Biol., Univ. South. Mississippi, Hattiesburg, MS 39401) **Effects of sublethal concentrations of pentachlorophenol on the liver of bluegill sunfish, *Lepomis macrochirus*.** *Bull. Environ. Contam. Toxicol.* 26(5): 594-600; 1981 (22 references).

Studies were conducted to determine the effects of sublethal levels of pentachlorophenol (PCP) on the liver of bluegill sunfish. Six-mo-old fish were acclimated to laboratory conditions, and then divided into control, starvation, and exposure groups. Control fish were fed daily; the other groups were not fed for 24 hr prior to and for the duration of the study. The exposure group was exposed to 0.1 mg PCP/l for 32 days. Starved unexposed and starved PCP-exposed bluegills exhibited liver glycogen depletion, cytoplasmic shrinkage, nuclear crowding and lipid accumulation. Glycogen loss occurred after only 1 day in starved unexposed and after 2 days in starved exposed fish; cytoplasmic shrinkage and nuclear crowding followed. After 32 days the livers were pale yellow, indicating a fatty condition. Lesions observed in these fish are not specifically related to PCP, but may demonstrate the effects of exposure to pesticides in general, and might be of use in alerting investigators to the presence of pesticides in an aquatic environment.

81-2544. Han Chin, B.; McKelvey, J. A.; Calisti, L. J.; Kozbelt, S. J.; Sullivan, L. J. (Dep. Saf. Assess., Diamond Shamrock Corp., Painesville, OH 44077) **A comparison of *in vivo* and *in vitro* (tissue explant) techniques: metabolic profile of methylethylbenzene isomers in rats and dogs.** *Bull. Environ. Contam. Toxicol.* 26(5): 621-625; 1981 (10 references).

A comparison was made of *in vivo* and *in vitro* methods for the determination of isomers of a hydrocarbon product of carbaryl, methylethylbenzene (MEB). The same techniques have been shown to be comparable when used for determination of the insecticide carbaryl. Rats and dogs were exposed to MEB by inhalation, then metabolic profiles of the test chemical in the urine were produced chromatographically. In *in vitro* tests, rat and dog livers were incubated with MEB, and metabolic profiles of the test chemical in the growth medium were produced. In the *in vivo* and *in vitro* tests in both rats and dogs, the major metabolites B, C, and D were produced. In addition, rat and dog livers produced significant amounts of metabolite A. It was concluded that the *in vitro* results semiquantitatively reproduced the *in vivo* urinary metabolism of MEB. The *in vitro* technique was shown to be species specific; therefore, it could be used to determine metabolism in man semiquantitatively without direct dosing of a human subject.

81-2545. Lawrence, L. J.; Dorough, H. W. (Dep. Entomol. & Grad. Cent. Toxicol., Univ. Kentucky, Lexington, KY 40536) **Retention and fate of inhaled hexachlorocyclopentadiene in the rat.** *Bull. Environ. Contam. Toxicol.* 26(5): 663-668; 1981 (3 references).

Studies were conducted to determine the fate and retention time of hexachlorocyclopentadiene (C56) in rats. The test animals were either exposed to ^{14}C-C56 vapors for single 1-hr periods, or dosed orally with ^{14}C-C56 in corn oil. Tissue, urine, and feces samples were analyzed, as well as expired air, to assess the fate and retention time. Approximately 84% of the inhaled compound is retained. Inhaled C56 is primarily excreted in the urine; orally administered C56 is eliminated in the feces. In rats exposed by inhalation, the trachea and lungs had the highest residues. The kidney and liver were major sites of residue accumulation in animals receiving oral doses. These studies indicate that the route of exposure is critical to the pattern of retention and elimination.

81-2546. Mulla, M. S.; Darwazeh, H. A.; Dhillon, M. S. (Dep. Entomol., Univ. California, Riverside, CA 92521) **Impact and joint action of decamethrin and permethrin and freshwater fishes on mosquitoes.** *Bull. Environ. Contam. Toxicol.* 26(5): 689-695; 1981 (8 references).

Three studies were conducted to determine the combined effects of decamethrin (0.001 and 0.005 lb/acre; 1.1 and 5.5 g/ha) and permethrin (0.025 and 0.125 lb/acre; 28 and 140 g/ha) on fish and mosquitos. The pesticides were applied for 8 successive wk to the mosquito fish *Gambusia affinis* and the pupfish *Cyprinodon macularius*. The 2nd test consisted of decamethrin applications for 6 successive wk against *G. affinis*. The 3rd test consisted of permethrin applied weekly for 6 wk against *G. affinis*. The 2 fish species were not affected by either concentration of the pesticides, even at levels 5 times the required larvicidal rate. Mosquitos were controlled after the first treatment with the high concentration and 2 days after each treatment with the lower concentrations. Mosquito larvae in ponds that were not treated with pesticides were eliminated by the

mosquito fish 25 days after the fish were introduced to the ponds.

81-2547. Mohsen, Z. H.; Mulla, M. S. (Dep. Entomol., Univ. California, Riverside, CA 92521) **Toxicity of blackfly larvicidal formulations to some aquatic insects in the laboratory.** *Bull. Environ. Contam. Toxicol.* 26(5): 696-703; 1981 (20 references).

Studies were conducted to determine the effects of several blackfly larvicides on 2 blackflies, and 2 nontarget species: an ephemeropteran *Baetis parvus* and a trichopteran *Hydropsyche californica.* The larvicides were used in a series of concentrations from which LC50 values could be determined. Two pyrethroids, FMC-45497 and decamethrin, were most toxic to the nontarget species (LC50 values of 0.0004-0.0011 ppm). Abate (temephos) and the DDT-related OMS-1356 showed excellent selectivity, being more toxic to the blackflies than to the nontarget species.

81-2548. Marking, L. L.; Chandler, J. H., Jr. (Natl. Fish. Res. Lab., US Fish & Wildl. Serv., LaCrosse, WI 54601) **Toxicity of six bird control chemicals to aquatic organisms.** *Bull. Environ. Contam. Toxicol.* 26(6): 705-716; 1981 (5 references).

Studies were conducted to determine the toxicity of several bird control substances to aquatic organisms. LC50 values are presented in tabular form for each compound tested and for each organism. PA-14 was most toxic to crustaceans, insects, snails, clams, and frogs, with 96-hr LC50 values < 10 mg/l. The compound 4-AP was toxic to glass shrimp and mayfly; the 96-hr LC50 values were 0.37 and 0.58 mg/l, respectively. Methiocarb was more toxic than PA-14 and 4-AP to crustaceans, aquatic insects, and snails. DRC-1339 96-hr LC50 values ranged from 1.6 (*Daphnia*) to 44 mg/l (frog larvae). DRC-1347 LC50 values ranged from 3.8 mg/l (mayfly nymph) to 62 mg/l (Asiatic clam). DRC-2698 LC50 values ranged from 4.5 (caddis fly larvae) to 96 mg/l (Asiatic clam). Studies on frog hatching success and larval survival indicate that 4-AP is the most toxic. Less than 10 mg 4-AP/l allowed < 5% hatching success and 2.0 mg 4-AP/1 allowed < 5% larval survival.

81-2549. Baxley, M. N.; Hood, R. D.; Vedel, G. C.; Harrison, W. P.; Szczech, G. M. (Dev. Biol. Sect., Dep. Biol., Univ. Alabama, Tuscaloosa, AL 35486) **Prenatal toxicity of orally administered sodium arsenite in mice.** *Bull. Environ. Contam. Toxicol.* 26(6): 749-756; 1981 (25 references).

Mice were used in studies carried out to determine possible effects of orally administered sodium arsenite on prenatal development. Pregnant mice were given a single dose of 20, 40, or 45 mg sodium arsenite/kg on one of days 8-15 of pregnancy. After sacrifice on day 18, litters were evaluated for prenatal mortality and gross malformations, and histological examinations were carried out. No teratogenic or maternal toxic effects were observed with the lowest dose. A low incidence of gross malformations occurred in litters from the 40 and 45 mg/kg groups, only when treatment occurred on day 8, 9, or 10 of gestation. Fetal mortality significantly increased with the 40 mg/kg dose administered on days 10 or 12, or with the 45 mg/kg dose administered on days 10, 12, 13, 14, or 15. Visceral examinations, light microscopy, and skeletal analysis revealed no treatment effects. Data are compared with a previous study in which arsenite was administered ip, resulting in more pronounced effects.

81-2550. Martin, A. D.; Norman, G.; Stanley, P. I.; Westlake, G. E. (Tolworth Lab., Agric. Sci. Serv., Min. Agric. Fish. & Food, Surbiton, Surrey, England) **Use of reactivation techniques for the differential diagnosis of organophosphorus and carbamate pesticide poisoning in birds.** *Bull. Environ. Contam. Toxicol.* 26(6): 775-780; 1981 (10 references).

A rapid and simple technique by which organophosphate and carbamate poisoning can be differentiated is described. Batches of day-old quail were dosed orally with an amount of each pesticide calculated to be three times the LD50. The pesticides used in the tests were carbophenothion, chlorfenvinphos, vinyl diethyl phosphate, dimethoate, mevinphos, pirimiphos-methyl, aldicarb, bendiocarb, methiocarb, oxamyl, pirimicarb, and thiofanox. All dosed birds died within 3 hr. After death, of the quail brains were homogenized and the post-mitochondrial supernatant was extracted and assayed for acetylcholinesterase activity. Both types of pesticides inhibited enzyme activity. After gel filtration and dilution, the activity of the carbamate-inhibited enzymes returned to normal levels. However, organophosphorus-inhibited enzyme activity did not spontaneously return. Chemical reactivation with 2-PAM increased activity of enzymes inhibited by both pesticide types. This procedure is recommended for differentiation between 2 types of poisoning.

81-2551. Hattula, M. L.; Wasenius, V. M.; Krees, R.; Arstila, A. U.; Kihlstrom, M. (Dep. Biol., Univ. Jyvaskyla, SF-40100 Jyvaskyla 10, Finland) **Acute and short-term toxicity of 2,3,4,6-tetrachlorophenol in rats.** *Bull. Environ. Contam. Toxicol.* 26(6): 795-800; 1981 (12 references).

Wistar rats were used in acute and short-term studies of the relationship of histopathological changes in tissues due to 2,3,4,6-tetrachlorophenol (TCP) treatment to residue levels in the tissues. In the acute experiments, ig doses of 0, 300, 360, 410, 432, 518, and 632 mg/kg were applied. All animals were sacrificed after 24 hr, and histopathological examinations were made of various

tissues. In the short-term tests, rats were dosed ig with 0, 10, 50, or 100 mg TCP/kg 7 days/wk for 55 days, then sacrificed and tissues examined as in the acute study. In the acute test, the highest TCP residues were found in the spleen (146 mg/kg), followed by kidney (47 mg/kg) and liver (34 mg/kg). Histopathological changes were limited to the liver. In the short-term study, the highest TCP residue levels were found in the spleen and kidney. Most tissue damage was confined to the liver, with severe necrosis of the liver parenchymal tissue. Possible mechanisms for the effect of tetrachlorophenol on the liver are discussed.

81-2552. Pope, P. E.; Holt, H. A. (Dep. For. & Nat. Resour., Purdue Univ., West Lafayette, IN 47907) **Paraquat influences development and efficacy of the mycorrhizal fungus *Glomus fasciculatus*.** *Can. J. Bot.* 59(4): 518-521; 1981 (14 references).

Soil from 48 soil cores, 15 cm in diameter and 60 cm in length were collected from seed beds fumigated with methyl bromide (0.05 kg/m²), and returned to each core. The soil was classified as a sandy loam (80% sand, and 13% clay with 7% silt) with 1.7% organic matter and moderately high levels of available nutrients. Two rates of fungal inoculum and 3 rates of paraquat were tested, with 8 replications. Paraquat at 2 kg AI/ha significantly reduced the mycorrhizal infection of white ash seedlings (*Fraxinus americana* L.) inoculated with the fungus *Glomus fasciculatus*. Paraquat reduced the amount of mycorrhizal hyphae from 8.8 cm/100 cm of roots to 4.9 and the number of vesicles from 5.7/cm of root to 0.9. Paraquat at 0.5 kg/ha had no significant effect on hyphae. Viability of the fungus measured by chlamydospore production was affected markedly by paraquat applications. With both paraquat concentrations, inoculated seedlings had significantly greater mycorrhizal infection, vesicle formation, and chlamydospore production than noninoculated seedlings. Paraquat at 0.5 kg/ha did not significantly influence P uptake or plant growth of inoculated seedlings. However, there was a trend toward increased foliar P concentration and seedling height. The mechanisms for stimulation of *G. gasciculatus* by paraquat is not known.

81-2553. Essigmann, E. M.; Newberne, P. M.* (Dep. Nutr. & Food Sci., Massachusetts Inst. Technol., Cambridge, MA 02139) **Enzymatic alterations in mouse hepatic nodules induced by a chlorinated hydrocarbon pesticide.** *Cancer Res.* 41(7): 2823-2831; 1981 (42 references).

Male C57BL/6 × C3H/anf F, mice fed the insecticide DCB [3-5-dichloro (N-1,1-dimethyl-2-propynyl) benzamide] for 24 mo showed evidence of chronic liver toxicity, decreased body wt, and an increased incidence of malignant tumors, which was not accompanied by an increased mortality. Alkaline phosphatase and glucose-6-phosphatase activities were good indicators of mouse hepatic nodules. γ-Glutamyl transpeptidase was only irregularly found in these lesions. Nodules also displayed decreased levels of aryl hydrocarbon hydroxylase activity and increased levels of pyruvate kinase (K form). Enzyme activity was also affected by nodular morphology and the type of treatment used.

81-2554. Pearson, M. N.; Beaudreau, G. S.; Deeney, A. O. (Dep. Agric. Chem., Oregon State Univ., Corvallis, OR) **Induction of endogenous viral gene expression by halogenated hydrocarbons.** *Carcinogenesis* 2(6): 489-494; 1981 (39 references).

The induction of endogenous virus gene expression in chick embryo cells by the DDT metabolites *bis*(chlorophenyl) acetic acid (*p,p'*-DDA) and *p,p'*-DDE, and the antibacterial agent hexachlorophene is reported. Primary and secondary cultures of chick embryo fibroblasts (CEF) were prepared. Cell cultures of line 100 × 7 C/ABE chick embryo cells were treated with several halogenated hydrocarbons which might be found as environmental contaminants. The DDT related compounds, *p,p'*-DDA and *p,p'*-DDE, produce the smallest increase in viral related enzyme while the positive control BrdU gave the greatest increase. Fluorescent antibody assays of the chemically induced cells also showed an increase in the number of cells expressing viral related proteins. The cultures treated with chemicals showed an increase in the number of cells expressing viral related proteins. These results demonstrated that in cell line 100 × 7 C/ABE DDT and its related compounds will induce production of viral particles as determined by assay for the viral specific reverse transcriptase enzyme.

81-2555. Vargova, M.; Rosival, L.; Janekova, D.; Lipkova, V.; Kovac, J.; Gajdova, M.; Korman, V.; Ciampor, F. (Res. Inst. Prev. Med., Res. Inst. Agrochem. Technol., Inst. Forensic Med., Med. Sch., Charles Univ., Bratislava, Czechoslovakia) **Toxikologicke hodnotenie noveho ceskoslovenskeho fungicidu trimorfamidu II. Subakutna toxicita. [Toxicological assessment of the new Czechoslovak fungicide trimorphamide. II. Subacute toxicity.]** *Cesk. Hyg.* 26(2): 55-65; 1981 (5 references) (Slovak).

Results of toxicological studies performed on groups of 20 male and 20 female rats following daily intake of 0, 510, 1274 and 2550 mg trimorphamide/kg feed over a 90 day period were evaluated. Weight increments of females of all experimental groups and of males fed 1274 mg/kg trimorphamide were significantly reduced. Average feed intake by males fed the 2 maximum doses was significantly reduced. Trimorphamide administration had no adverse effect on liver and renal funtions. Hematological and histological findings were normal. Electron microscopic examination failed to reveal significant structural changes. The blood level of trimorphamide in animals fed the highest doses declined during the experi-

ment from 0.28 mg/kg to 0.10 mg/kg after 12 wk. Urine content increased from 8.6 mg/kg to 14.3 mg/kg after 12 wk. Liver content of trimorphamide at the end of the experiment was 0.4 mg/kg in high dose animals and 0.2 mg/kg in medium dose animals.

81-2556. Cerna, M. (Inst. Post-Grad. Educ. Physicians & Pharm., Prague, Czechoslovakia) **Geneticke riziko chemickych latek pritomnych v pozivatinach na zaklade zasahu cloveka. [Genetic risk of chemical food additives on the basis of the activity of a man.]** *Cesk. Hyg.* 26(3): 147-159; 1981 (102 references) (Czech).

Available research findings on mutagenic and carcinogenic effects of food contaminants and additives were reviewed. DDT was found to be mildly mutagenic and potentially carcinogenic. HCB (hexachlorobenzene) and dithiocarbamates (ethylenethiourea) were mutagenic. Heptachlor is considered potentially mutagenic. Phenoxycarboxylic acid may be teratogenic due to the presence of dioxin. The potential ability of plant enzymes to metabolize some of these substances must be considered. In assessing the genetic risk arising from contaminants and additives in foods, the presence of mutagens and carcinogens, their comprehensive effect, and changes induced in the course of production must be considered.

81-2557. Karenlampi, S. O.; Hynninen, P. H. (Dep. Biochem., Univ. Kuopio, SF-70101 Kuopio 10, Finland) **Formation of benzoic acid from biphenyl in the yeast *Saccharomyces cerevisiae*.** *Chemosphere* 10(4): 391-396; 1981 (21 references).

Yeast *Saccharomyces cerevisiae* was adapted to growth on agar containing biphenyl, the parent compound of PCB. Gas chromatographic- mass spectrophotometric analysis of degradation products suggested that *S. cerevisiae* might break down biphenyl via muconic acid analogues, a pathway used by bacteria. Some benzoic acid was detected in the incubation mixtures, but no hydroxylated biphenyls were found in cultures of yeast with or without cytochrome P450. No metabolic intermediates between biphenyl and benzoic acid were detected, possibly because of the rapid metabolism of the compound in a liquid medium.

81-2558. Gray, C.; Knowles, C. O. (Dep. Entomol., Univ. Missouri, Columbia, MO 65211) **Metabolic fate and tissue residues of propamocarb in bluegills and channel catfish.** *Chemosphere* 10(5): 469-478; 1981 (3 references).

A study is described in which metabolism and residues of the fungicides propamocarb are examined in bluegill and channel catfish. Bluegill and channel catfish were injected ip with radiolabeled propamocarb at dosages corresponding to 2.25 ± 0.36 mg/kg and 1.73 ± 0.25 mg/kg, respectively. The radiocarbon content of the fish, the water, and the feces was measured after 6 and 24 hr. Propamocarb elimination was found to be rapid in both species, with 72% of the dose detectable in the water by 24 hr. In the catfish, most of the radiocarbon in the water partitioned into methylene chloride. In the bluegill, most of the radiocarbon was water soluble. Catfish tissues contained higher levels of acetonitrile-soluble radioactive material, while bluegill contained appreciably more water-soluble radiocarbon. Examination of propamocarb-^{14}C equivalent in selected tissues 24 hr after injection indicates high concentration in the bile (12.74 mg/kg for bluegill) and low concentration in the fat (0.11 mg/kg). Propamocarb apparently does not pose a hazard to bluegill and channel catfish due to its rapid metabolism and elimination, and low residue levels in tissues.

81-2559. Crow, K. D. (Dep. Dermatol., Princess Margaret Hosp., Swindon SN1 4JU, England) **Chloracne and its potential clinical implications.** *Clin. Exp. Dermatol.* 6(3): 243-257; 1981 (53 references).

Chloracne may be defined as an acneiform eruption due to poisoning by halogenated aromatic compounds having a specific molecular shape. The following substances have been shown to cause chloracne in humans and in some experimental animals: chlornaphthalenes, polychlorinated biphenyls, polychlorinated dibenzofurans, polychlorinated dibenzodioxins, tetrachloroazobenzene, and tetrachloroazoxybenzene. The degree of halogenation does not necessarily determine toxicity; however, the position of the halogen atoms on the outside of the molecule is vital. The distribution of the lesions is of considerable diagnostic importance. Pigmentation is largely confined to the face, but in the worst cases may extend more widely. Clinical reports of chloracne from exposure to these agents are reviewed, and clinical manifestations are described. Hypertrichosis, a rare finding, is mainly confined to the temples and may be secondary to hepatic porphyria caused by TCDD exposure. Follicular hyperkeratosis in rare cases may accompany severe chloracne. Conjunctivitis and erythema changes also occur occasionally. Clinical signs and symptoms of chloracne in non-cutaneous systems include weight loss, hepatic changes, lipoprotein abnormalities, central and peripheral neurological changes, pulmonary changes, porphyria, hyperhidrosis, and gastrointestinal, musculoskeletal, and immunological changes. Possible carcinogenic effects and routes of absorption are discussed.

81-2560. Harri, M. N. E. (Dep. Physiol., Univ. Kuopio, SF-70101 Kuopio 10, Finland) **Hepatic mixed function oxidase (MFO) activities during the seasonal life cycle of the frog *(Rana temporaria).*** *Comp. Biochem. Physiol. C* 67(1): 75-78; 1980 (15 references).

A single dose of DDT (5 mg/kg) did not affect the activities of hepatic mixed function oxidase (MFO) com-

ponents in fed summer frogs, *Rana temporaria*. The activity of MFO system showed remarkable seasonal variation with its higher activity level during the summer period. The MFO activity tended to be lower in the females than in the males at the beginning of spawning time, while at the end of the spawning the reverse tendency was observable. In frogs overwintered in laboratory the activity levels of MFOs were lower than in frogs undergone a natural wintering. The activity levels in an immature female resembled those observable in mature males. (Author abstract by permission)

81-2561. Cranz, C.; Clavert, A.; Dellenbach, P. (Lab. Embryol., Fac. Med. Strasbourg, France) **A propos d'un cas de sterilite reversible par intoxication chronique probable au lindane. [A case of reversible sterility probably due to intoxication by lindane.]** *Contraception Fertil. Sex.* 9(6): 421-423; 1981 (10 references) (French).

A farmer and his wife were seen at a consultation for sterility. The volume of the ejaculate and spermatozoa concentration were normal; asthenospermia (5% of the spermatozoa having normal motility), necrospermia (60% dead spermatozoa), and teratospermia (60% abnormal spermatozoa) were found. The necrospermia was suspected to be due to the action of a toxic substance on the epididymis. Erythroderma of the hands and forearms following the handling of pesticides without protective means was also observed in the husband. The insecticide used consisted of 15% magnesium silicate, 15% methoxyethyl magnesium, 40% lindane, and 30% anthraquinone. The insecticide exposure was regular during the period from April to November. The use of gloves and mask, and thorough washing of the exposed skin areas after insecticide application, were recommended. Pregnancy occurred several months after the introduction of these protective measures. Examinations performed 1 mo after the beginning of the pregnancy showed the complete disappearance of necrospermia, 20% spermatozoa of good motiliy and quality, but persisting teratospermia.

81-2562. Nagaratnamma, R.; Ramamurthi, R. (Dep. Zool., Sri Venkateswara Univ., Tirupati 517502, India) **Comparative evaluation of methyl parathion toxicity of some selected freshwater organisms.** *Curr. Sci.* 50(7): 334-335; 1981 (8 references).

A laboratory aquatic ecosystem was exposed to LC50 doses of methyl parathion for 8 or 24 hr. Reactions of the teleost *Cyprinus carpio*, the leech *Poecilobdella granulosa*, the pond snail *Pila globosa*, the freshwater mussel *Lamellindens marginalis*, and the field crab *Oziotelphusa senex senex* were examined. Crabs and leeches showed the least tolerance to methyl parathion while fish and mollusks exhibited good tolerance. A tight closing of the shell of mollusks during pesticide exposure was observed, which may play a role in their ability to tolerate methyl parathion. Body wt contributed to the ability of carp to withstand pesticide exposure.

81-2563. Siklosi, V. C.; Simon, N.; Koszo, F. (Univ. Hautklin., H-8701 Szeged, Hungary) **Die Wirkung einiger Hexachlorbenzol- Katabolite auf den porphyrinstoffwechsel der Ratte. [The effect of some hexachlorobenzene catabolites on the porphyrin metabolism of rats.]** *Dermatosen Beruf Umwelt* 29(2): 40-42; 1981 (16 references) (German).

The possible role of hexachlorobenzene metabolites in toxic hexachlorobenzene porphyria was studied in rats fed pure hexachlorobenzene (0.2% of the diet) or mixtures in which 20% of the hexachlorobenzene was replaced by pentachlorophenol (PCP), 1,2,4,5-tetrachlorobenzene, 1,2,3,4-tetrachlorobenzene, 1,2,3,5-tetrachlorobenzene, 2,3,4,5-tetrachlorophenol, 2,3,5,6-tetrachlorophenol, 2,3,4,6-tetrachlorophenol, or chloranil. None of the metabolites caused any increase in the urinary porphyrin level. A decrease in the porphyrin level was observed in some cases. It is concluded that none of the metabolites tested is the hexachlorobenzene metabolite responsible for hexachlorobenzene porphyria.

81-2564. Dishovski, H. D.; Yanev, S. G. (Higher Milit. Med. Inst., Sofia, Bulgaria) **Effect of the organophosphorus compound Neguvon and the reactivator of cholinesterase TMB-4 on monoaminooxidase activity of rat's brain.** *Dokl. Bolg. Akad. Nauk* 34(3): 379-381; 1981 (10 references).

The mechanisms of action of organophosphorus compounds (OPC) on the system of biogenic amines in the brain was studied. Monoaminooxidase (MAO) activity of the brain of rats treated with the pesticide Neguvon (trichlorfon) or the antidote reactivator of cholinesterase, TMB-4, was determined. Neguvon was applied at a dose of 200 mg/kg either alone or followed by 20 mg/kg TMB-4. Neguvon caused a significant decrease in the MAO activity of the rat brain. Treatment with TMB-4 10 min after intoxication prevents the inhibition of MAO on 2 of the 3 substrates tested. The MAO-inhibiting properties of Neguvon may be due to the presence of alkylating properties of its active metabolite DDVP; Neguvon's ability to increase acetylcholine concentration at synapses may contribute to its inhibitory effect on MAO. The ability of TMB-4 to form a complex with Neguvon or to reactivate acetylcholinesterase may explain its protective effect.

81-2565. Lien, E. J.; Koda, R. T. (Sch. Pharm., Univ. S. California, Los Angeles, CA 90033) **Structure-side effect sorting of drugs: V. Glaucoma and cataracts associated with drugs and chemicals.** *Drug Intell. Clin. Pharm.* 15(6): 434-439; 1981 (71 references).

Results of a survey conducted on drug- or chemical-induced glaucoma and/or cataracts are summarized. Among the glaucoma-inducing agents mentioned are mydriatics (atropine, belladonna, and anticholinergics), topical corticosteroids, dexamethasone, and anticholinesterase DFP, echothiophate, demercarium bromide, and paraoxon are known to cause lenticular opacities. Some narcotic analgesics and anticancer agents have been shown to cause lens opacities. Galactose, glucose and xylose have also been reported to cause cataracts. Tables are given which alphabetically list glaucoma-inducing or cataract-inducing chemicals.

81-2566. Hays, D. P. (Dep. Pediatr., Med. Cent., Univ. Massachusetts, Worcester, MA 01605) **Teratogenesis: a review of the basic principles with a discussion of selected agents: part I.** *Drug Intell. Clin. Pharm.* 15(6): 444-458; 1981 (184 references).

The effects of specific drugs and drug classes on the human fetus are reviewed. Drugs that effect the fetus may cause structural (teratogenic) or metabolic defects. Awareness of when pregnancy begins and what drugs should be avoided during pregnancy is necessary to prevent teratogenic effects to the fetus. New regulations for drug labeling of teratogenic effects were adopted in 1980 and should increase the available information on teratogenic drugs. These drugs are classified into 3 categories according to their teratogenic effects. Among the embryotoxins mentioned are arsenic, captan, carbaryl, chlordecone, linuron, malathion, methoxychlor, and warfarin. Alternatives to the use of the anticoagulant warfarin in pregnancy are discussed. An appendix summarizes the defects caused by drugs in embryos of humans and other species.

81-2567. O'Neill, J. P.; Forbes, N. L.; Hsie, A. W. (Biol. Div., Oak Ridge Natl. Lab., Oak Ridge, TN) **Cytotoxicity and mutagenicity of the fungicides captan and folpet in cultured mammalian cells (CHO/HGPRT System).** *Environ. Mutagenes* 3(3): 233-237; 1981 (13 references).

Cultured Chinese hamster ovary (CHO) cells were used to assay the toxicity and mutagenicity of the fungicides captan and folpet. During exponential cell growth the cultures were exposed to folpet and captan at concentrations of 0.1-4.0 μg/ml. Cytotoxicity was measured as cloning efficiency (% relative to control). Phenotypic expression was measured as selection of 6-thioguanine-resistant mutants. Both compounds are similar in cell lethality; slight effects occurred at 0.1-0.5 μg/ml, with exponential killing at 1-4 μg/ml. Both compounds caused dose-related increases in mutagenicity. It is recommended that the genetic hazard of these substances be considered further.

81-2568. Bakshi, K. S.; Brusick, D. J.; Summer, D. D. (Natl. Acad. Sci., Washington, DC) **Mutagenic activity of corn plants grown in untreated and atrazine (Aatrex) treated soil.** *Environ. Mutagenesis* 3(3): 302-303; 1981.

The mutagenic activity of the extracts of corn plants grown in the presence and absence of atrazine were determined. *Salmonella typhimurium* strains were used in the mutagenicity tests. The extracts of atrazine- and non-atrazine-grown corn did not result in significantly different mutagenic activity. It is suggested that the mutagenic effects seen with both samples may be due to a natural component of corn plant extract, or may be a product of some parasitic organism. [Presented at the 12th annu. meet. of the Environ. Mutagen Soc.]

81-2569. Brimer, P. A.; Tan, E. L.; Hsie, A. W. (Oak Ridge Grad. Sch. Biomed. Sci., Univ. Tennessee, Oak Ridge, TN 37830) **Effect of metabolic activation on the mutagenicity and cytotoxicity of ethylene dibromide in the CHO/HGPRT system.** *Environ. Mutagenesis* 3(3): 317-318; 1981.

The mutagenicity and cytotoxicity of ethylene dibromide were tested in the CHO/HGPRT system. To provide metabolic activation, S-9 mixes were prepared with 10 m*M* $MgCl_2$ (Mg-S9) or with 10 m*M* $CaCl_2$ plus 10 m*M* $MgCl_2$ (Ca/Mg-S9). The cytotoxicity of ethylene dibromide in the absence of NADP in the S9 mixes was similar to that when the compound was tested as a direct-acting mutagen. Addition of NADP to the S9 mixes caused a 3-10-fold increase in cytotoxicity. The mutagenicity of ethylene dibromide when Mg-S9 without NADP was added was about half that obtained in the direct assay and the Ca/Mg-S9 assay without NADP. The Ca/Mg-S9 assay showed approximately twice the cytotoxicity and mutagenic activity of the Mg-S9 assay. [Presented at the 12th annu. meet. of the Environ. Mutagen Soc.]

81-2570. Riccio, E.; Shepherd, G.; Pomeroy, A.; Mortelmans, K.; Waters, M. D. (SRI Int., Menlo Park, CA 94025) **Comparative studies between the *S. cerevisiae* D3 and D7 assays of eleven pesticides.** *Environ. Mutagenesis* 3(3): 327; 1981.

The *Saccharomyces cerevisiae* D3 and D7 assays in the absence and presence of rat metabolic activation systems were compared using 11 pesticides. Mitotic crossing over, gene conversion, and reverse mutation in the D7 were caused by acephate, cacodylic acid, demeton, monocrotophos, and trichlorofon. Tests with azinphos-methyl, bromacil, disulfoton, monuron, parathion-methyl, and simazine were all negative. It is concluded that both D3 and D7 tests are comparable for detecting mitotic recombination. However, the D7 is able to differentiate between three different endpoints, and is thus a more advantageous test. [Presented at the 12th annu. meet. of the Environ. Mutagen Soc.]

81-2571. Telang, S.; Tong, C.; Williams, G. M. (Naylor Dana Inst. Dis. Prev., Am. Health Found, Valhalla, NY 10595) **Induction of mutagenesis by carcinogenic polycyclic aromatic hydrocarbons but not by organochlorine pesticides in the ARL/HGPRT mutagenesis assay.** *Environ. Mutagenesis* 3(3): 359; 1981.

The adult rat liver epithelial cell hypoxanthine-guanine phosphoribosyl transferase (ARL/HGPRT) assay was used to evaluate the mutagenicity of 2 groups of carcinogens, polycyclic aromatic hydrocarbons and organochlorine pesticides. Results indicate significant dose-dependent increases in mutant incidences with the polycyclic aromatic hydrocarbon carcinogens benzo(a)pyrene and 7,12-dimethylbenz(a) anthracene. The organochlorine pesticides DDT, mirex, kepone (chlordecone), PCL Hex, endrin, heptachlor, and chlordane showed no positive responses in this assay, although they have been shown to be hepatocarcinogens in various species. It is suggested that the carcinogenic mechanisms in operation may not be those that are well studied and operating at the genetic level. [Presented at the 12th annu. meet. of the Environ. Mutagen Soc.]

81-2572. Sandhu, S. S.; Kasica, V. A.; Waters, M. D.; Evans, E. L.; Jotz, M. M.; Mitchell, A. D.; Mortelmans, K. E. (US EPA, Research Triangle Park, NC 27711) **Mutagenicity evaluation of diallate and triallate herbicides in a battery of short-term tests.** *Environ. Mutagenesis* 3(3): 361; 1981.

Results of short-term mutagenicity tests on the herbicides diallate and triallate are presented. Both compounds produced positive results as point/gene mutagens in the Ames *Salmonella* microsome assay and in the L5178Y mouse lymphoma thymidine kinase assay. Genetic activity was dependent on Arochlor-induced rat liver S9 activation. Both herbicides were negative in the *Saccharomyces cerevisiae* D7 assay for crossing over, mitotic gene conversion, and reverse mutation. Only diallate was positive in the *Drosophila* sex-linked recessive lethal test. It is noted that more work is required to completely assess the genetic activity of these compounds. [Presented at the 12th annu. meet. of the Environ. Mutagen Soc.]

81-2573. Douglas, G. R.; Nestmann, E. R.; Grant, C. E.; Bell, R. D. L.; Wytsma, J. M.; Kowbel, D. J. (Mutagenesis Sect., Environ. & Occup. Toxicol. Div., Dep. Natl. Health & Welfare, Ottawa, Ontario K1A OL2, Canada) **Mutagenic activity of diallate and triallate determined by a battery of *in vitro* mammalian and microbial tests.** *Environ. Mutagenesis* 3(3): 361; 1981.

Results are presented from some *in vitro* mammalian and microbial tests carried out to determine the mutagenic activity of the thiocarbamate herbicides diallate and triallate. Both were positive in the *Salmonella*/mammalian microsome assay. They were active in strains TA1535, TA100, and TA98 without activation, indicating frameshift mutations and base substitutions. Mutagenicity was increased by incubation with S9. In *in vitro* tests with Chinese hamster ovary cells, both herbicides caused dose-related decreases in colony-forming ability, along with increases in the frequencies of cells with chromosome damage and in the number of sister-chromatid exchanges. Only diallate caused a reduction in DNA molecular wt, determined by alkaline sucrose gradient sedimentation, indicating that these lesions may not be related to those which produce chromosomal damage. Although the data indicate these herbicides to be mutagens in mammals, it is noted that appropriate *in vivo* methodology must be applied to determine risk to humans. [Presented at the 12th annu. meet. of the Environ. Mutagen Soc.]

81-2574. Naismith, R. W.; Matthews, R. J.; Tan, E. L.; Hsie, A. W. (Pennsylvania State Univ., Biol. Div., ORNL, State College, PA) **An apparent lack of mutagenic response of sodium azide in several mammalian mutational assays.** *Environ. Mutagenesis* 3(3): 364-364; 1981.

Studies were conducted on the mutagenic response of mammals to sodium azide. Mutagenic assays were conducted on mammalian cells (CHO/HGPRT). The respiratory poison did not increase mutagenic activity up to 200 m*M*. An *in vivo* assay on mice (up to 20 mg/kg/day) and an *in vivo* assay on rats (up to 10 mg/kg/day) produced marked symptoms, but no mutagenic effect. [Presented at the 12th annu. meet. of the Environ. Mutagen Soc.]

81-2575. Lebowitz, H.; Young, R.; Galloway, S.; Brusick, D. (Litton Bionetics Inc., Kensington, MD 20795) **The effect of *N,N*-diethyltoluamide (DEET) on sperm number, viability and head morphology in male rats treated dermally.** *Environ. Mutagenesis* 3(3): 370; 1981.

Studies were carried out to determine the effects of N,N-diethyltoluamide (Deet) on rat testes and gametes. Dermal applications were made on male rats at levels of 0, 100, 300, and 1000 mg Deet/kg/day, 5 days/wk for 9 wk. After 35, 65, and 95 days, sperm samples were collected, counted, assayed for viability, and examined for sperm head abnormalities. No evidence was seen of toxicity or sperm head abnormalities. No changes were seen in testicular histopathology or weight. However, weight changes were observed in the kidneys and livers. [Presented at the 12th annu. meet. of the Environ. Mutagen Soc.]

81-2576. Sega, G. A.; Cumming, R. B.; Owens, J. G.; Horton, C. Y.; Lewis, L. R. (Biol. Div., Oak Ridge Natl. Lab., Oak Ridge, TN 37830) **Alkylation pattern in developing mouse sperm, sperm DNA and protamine after inhala-**

tion of ethylene oxide. *Environ. Mutagenesis* 3(3): 371; 1981.

Ethylene oxide (ETO) inhalation studies were used to determine alkylation patterns in developing mouse sperm, sperm DNA, and protamine. Mice were exposed to 1.5-3.0 ppm-hr ^{3}H-ETO, and sperm were recovered. Sperm in the mid to late spermatid stages during exposure showed maximum alkylation (6-7 × 10^3 alkylations/sperm/ppm-hr). DNA samples showed an average alkylation level of 3-6 × 10^{-9} alkylations/dN/ppm-hr. Protamine of the mid to late spermatids appeared to be alkylated about 7 times as much as that of early spermatid and late spermatid stages. It is concluded that mid to late spermatid stages may be more susceptible than other stages to chromosome damage by ETO. [Presented at the 12th annu. meet. of the Environ. Mutagen. Soc.]

81-2577. Kasica, V. A.; Sandhu, S. S.; Waters, M. D. (US EPA, Research Triangle Park, NC 27711) **Quantitative methods for assessing mutagenicity from short-term assays: diallate and triallate as examples.** *Environ. Mutagenesis* 3(3): 382; 1981.

The mutagenicity of the structurally similar herbicides diallate and triallate was studied. Five strains of *Salmonella typhimurium* and *Saccharomyces cerevisiae* D7 were exposed to these compounds. Three strains of *Salmonella* showed signs of mutagenicity. The statistical analyses used also indicate a non-detectable mutagenic activity in *Saccharomyces* D7. [Presented at the 12th annu. meet. of the Environ. Mutagen Soc.]

81-2578. Singh, H.; Singh, T. P. (Fish Endocrinol. Lab., Dep. Zool., Banaras Hindu Univ., Varanasi 221005, India) **Short-term effect of two pesticides on lipid and cholesterol content of liver, ovary and blood serum during the pre-spawning phase in the freshwater teleost, *Heteropneustes fossilis* (Bloch).** *Environ. Pollut. Ser. A* 22(2): 85-90; 1980 (18 references).

The effects of cythion (malathion) and hexadrin (endrin) on lipid and cholesterol content of liver, ovary, and blood serum of the food fish *Heteropneustes fossilis* were studied in India. Prespawning fish were dosed with the 96-hr initial median lethal concentration [LC(I)50] or with the highest concentration that does not produce any harmful effect (SC) for each pesticide for 4 days. Liver and ovarian lipid, blood serum, and liver cholesterol were unaffected. Ovarian cholesterol increased from 569.29 mg/100 g in controls to 754.16 mg/100 g in fish treated with SC of cythion (9 ppm), 884.8 mg/100 g in fish treated with LC(I)50 of cythion (45 ppm), 843.06 mg/100 g in fish treated with SC of hexadrin (0.0006 ppm), and 822.94 mg/100 g in fish treated with LC(I)50 of hexadrin (0.02 ppm). It is suggested that the pesticide results in reduced utilization of cholesterol by ovaries, resulting in increased levels of ovarian cholesterol in tested fish.

81-2579. Anderson, R. L.; DeFoe, D. L. (Environ. Res. Lab., US EPA, Duluth, MN 55804) **Toxicity and bioaccumulation of endrin and methoxychlor in aquatic invertebrates and fish.** *Environ. Pollut. Ser. A* 22(2): 111-121; 1980 (21 references).

The effects of endrin and methoxychlor on aquatic organisms were studied. For endrin tests a species of caddis fly, stonefly, and bullhead catfish were used. For methoxychlor a species of caddis fly, stonefly, isopod, and snail were tested. Endrin test concentrations ranged from 0.03 to 0.60 μg/l; methoxychlor ranged from 0.15 to 4.23 μg/l. Test organisms were exposed to these concentrations in flowing water for 28 days. Endrin caused behavioral changes in the caddis fly and stonefly in 4 days at 0.07 and 0.15 μg/l, respectively. Endrin 28-day LC50 values were < 0.03 μg/l for the caddis fly, 0.07 μg/l for the stonefly, and 0.10 μg/l for the isopod and 1.3 μg/l for the caddis fly. Even the highest concentrations of this compound were not lethal to the stonefly or snail species. Bioaccumulation studies indicated that stoneflies concentrated endrin and methoxychlor 1150 and 350 times, respectively, above the test water levels. Snails concentrated methoxychlor up to 8600 times.

81-2580. Mukhopadhyay, P. K.; Dehadrai, P. V. (Cent. Inland Fish. Res. Inst., Indian Counc. Agric. Res., Barrackpore 743101, West Bengal, India) **Biochemical changes in the air-breathing catfish *Clarias batrachus* (Linn.) exposed to malathion.** *Environ. Pollut. Ser. A* 22(2): 149-158; 1980 (33 references).

The effects of malathion on the air-breathing catfish *Clarias batrachus* was studied. Fish were exposed to 0.5 ppm malathion in a semi-continuous flow bioassay system for 40 days. Lysine incorporation into the liver, blood counts, hepatic protein and nucleic acids, liver and gill esterase activity and accumulation of pesticide in tissues were monitored. Protein synthesis in the liver, as determined by lysine incorporation, was reduced by the pesticide. Leukocytes and total cells increased; erythrocytes, hemoglobin, and hematocrit decreased. Liver glycogen decreased; hepatic protein and nucleic acids did not change. Liver and gill enzyme activity decreased. Malathion accumulated mainly in the gills, at a rate of 70.6 μg/g wet tissue. Liver and kidney levels were undetectable.

81-2581. Biessmann, A.; von Faber, H. (Inst. Zool. Workgroup Endocrinol., Univ. Hohenheim, D-7000 Stuttgart 70, Hohenheim, BRD) **Effects of DDT and its metabolites on the adrenal gland of Japanese quail.** *Environ. Pollut. Ser. A* 25(2): 99-104; 1981 (24 references).

Studies were conducted in which 5-wk-old quail were dosed with 50 and 250 ppm *p,p'*-DDT, or 300 ppm *p,p'*-DDE for 5 or 9 wk. Adrenal wt in every treatment group increased. The percentage of adrenal cortical tissue also increased. Nuclear size of the cortical and medullary

cells, and lipid content of the interrenal cords did not change. It is concluded that the action of DDT and its metabolites on the adrenal cortex is via a hyperplasia.

81-2582. Cooke, A. S. (Inst. Terr. Ecol., Monks Wood Exp. Stn., Abbots Ripton, Huntingdon PE17 2LS, England) **Tadpoles as indicators of harmful levels of pollution in the field.** *Environ. Pollut. Ser. A* 25(2): 123-133; 1981 (31 references).

A bioassay procedure using tadpoles (*Rana temporaria*) to detect harmful pollutant levels is presented. Caged tadpoles were placed in runoff ditches near pesticide-treated fields to assess the impact of pesticides. At regular intervals, mortality, growth, rate of metamorphosis, and occurrence of deformities were recorded. Oxamyl-treated potato fields were found to result in a high incidence of deformities; significantly higher incidences of vertical curvature deformities and tail tip deformities were observed. Tadpoles were also treated with oxamyl in the laboratory. Exposure to 100 ppm oxamyl for 1 hr resulted in 90% tadpoles with vertical curvature deformities, similar to those observed in the field. Laboratory treatment with oxamyl did not result in tail tip deformities.

81-2583. Haseltine, S.; Hensler, G. (Patuxent Wildl. Res. Cent., US Fish & Wildl. Serv., Laurel, MD 20811) **Growth of mallards fed phosphamidon for 13-day periods during three different developmental stages.** *Environ. Pollut. Ser. A* 25(2): 139-147; 1981 (20 references).

Studies were conducted to determine the effects of phosphamidon on mallard duck growth. Ducklings were fed 0, 0.5, or 5.0 ppm for a 13-day period at 3 different times during the 70-day growth period (days 5-17, 18-30, or 31-43). Birds treated on days 5-17 had slower primary feather development. Although there were some differences in growth patterns, they were attributed to experimental conditions. Brain cholinesterase levels did not decrease following phosphamidon exposure after 24 hr or at 10 wk of age.

81-2584. Kurzel, R. B.; Cetrulo, C. L. (Tufts Univ. Sch. Med., Boston, MA 02125) **The effect of environmental pollutants on humans reproduction, including birth defects.** *Environ. Sci. Technol.* 15(6): 626-640; 1981 (156 references).

An overview of environmental pollutants is given with a special emphasis on teratogenic agents. Teratology is defined, and some factors that play a role in the susceptibility of a fetus to teratogenic defects are discussed. Little is known about the toxic mechanisms of chemical teratogens in the human fetus. Among the air pollutants suspected of having teratogenic effects are carbon monoxide, ozone, vinyl chloride, benzene, nitrous oxide, and tetrachloroethylene. Certain food additives including food dyes, artifical sweeteners, diethylstilbestrol, preservatives, and caffeine have been investigated for their teratogenic effects. Inadvertent food additives such as PCBs, PBBs, and pesticides are environmental pollutants whose teratogenicity is still uncertain. DDE, DDT, lindane, dieldrin, and heptachlor epoxide have been detected in fetal cord blood and tissues of stillborn infants, confirming the transplacental transfer of these compounds. Questions on the teratogenicity of phenoxyacetic acids and TCDD arose following the use of these compounds in Agent Orange (2,4-D + 2,4,S-T) during the Vietnam War. The teratogenicity of metals and other inorganic compounds is considered along with the toxicity of breast milk containing organochlorines to newborn infants. Some future problems facing teratologists are outlined.

81-2585. Kutsenko, S. A.; Savateev, N. V. (S. M. Kirov Mil. Med. Acad., Leningrad, USSR) **Katekholaminy mozga pri ostrom otravlenii krys dimetoksidkhlorvinilfosfatom. [Brain catecholamines in rats with acute dimethoxydichlorovinyl phosphate poisoning.]** *Farmakol. Toksikol. (Moscow)* 44(3): 334-338; 1981 (17 references) (Russian).

The effect of the organophosphorus insecticide dimethoxydichlorovinylphosphate (DMDVP) on the level of brain catecholamines was studied in random-bred albino rats. DMDVP was administered ip at 10 mg/kg; 30 min later animals were sacrificed and catecholamines were assayed histochemically. DMDVP administration produced a 40-60% inhibition of brain anticholinesterase activity. DMDVP also induced accumulation of dopamine in the caudal and septal nuclei and increased noradrenaline accumulation in the blue spot.

81-2586. Kingsbury, P. D.; McLead, B. B. (For. Pest Manage. Inst., Can. For. Serv., Sault Ste. Maire, Ontario, Canada) **Impact at various spray timings.** *For. Pest. Manage. Inst. Rep. FPM-X* 29: 77 pp.; 1980 (1 reference).

The effects of the insecticide aminocarb on breeding bird populations were assessed. Aminocarb was used in spruce budworm control in Canada and was sprayed on 3 occasions by aircraft at a dosage rate of 0.052 kg AI/ha. Sprayings were done when 50% of 2nd instar budworm had emerged, at the time of peak 4th instar larvae, and 5 days following the 4th instar treatment. The bird surveys were made by assessing populations on 4-ha plots in treated and untreated areas using a singing-male territory technique. The survey showed that breeding territories remained intact, and no immediate or short-term effect was noted following any of the treatments. No pesticide-related population declines were indicated, and no symptoms of pesticide stress (erratic flight, bill wiping, wing droop) were observed.

81-2587. Kingsbury, P. D.; Kreutzweiser, D. P. (For. Pest. Manage. Inst. Can. For. Serv., Sault Ste. Marie, On-

tario, Canada) **Environmental assessment of semi-operational permethrin application.** *For. Pest. Manage. Inst. Rep. FPM-X* 30: 47 pp.; 1980 (8 references).

An environmental impact study was made of application of the synthetic pyrethroid insecticide permethrin to an entire headwater stream watershed and surrounding forest block under simulated operational conditions. Permethrin at a rate of 17.5 g AI/ha was applied to a 640-ha forest block in northern Ontario. Results of residue analysis indicate that permethrin disappears rapidly from standing and flowing water, with negligible persistence in bottom sediments. However, persistance was greater in foliage, soil, and litter, with detectable amounts still remaining at the end of the 58-day sampling period. The permethrin application caused a noticeable increase in the number of drifting organisms for 24 hr after spraying. No lethal effects were observed in yellow perch and they did not accumulate in detectable amounts. No measurable effects were seen in small mammal populations. Brief impacts were observed in arboreal, flying, and ground dwelling invertebrates. Application of 17.5 g AI/ha permethrin on a large scale did not introduce or compound hazards further than that documented from small-scale exposure applications.

81-2588. Kingsbury, P. D.; Holmes, S. B.; Millikin, R. L. (For. Pest Manage. Inst., Can. For. Serv., Sault Ste. Marie, Ontario, Canada) **Environmental effects of a double application of azamethiphos on selected terrestrial and aquatic organisms.** *For. Pest. Manage. Inst. Rep. FPM-X* 33: 32 pp.; 1980 (10 references).

Studies were designed to assess effects of the insecticide azamethiphos on nontarget forest organisms. Two azamethiphos (iodofenphos) applications were made 6 days apart, at a rate of 0.070 kg AI/ha. Evaluation was made of effects on terrestrial invertebrates, bottom fauna, and fish diet. There were no obvious harmful effects on songbirds or native fish. Some changes occurred in the diet of brook trout, but there was no significant reduction on overall food availability. Except for a large increase in the drift of caddis fly larvae, there was little effect on aquatic invertebrates. The most obvious effect was on terrestrial invertebrates. Terrestrial invertebrate knockdown was 9 times that of controls on application days, but effects were still seen up to 5 days after spraying.

81-2589. Kingsbury, P. D.; McLead, B. B. (For. Pest Manage. Inst., Sault Ste. Marie, Ontario, Canada) **The impact of spruce budworm *Choristonuera fumiferana* Clemens control operations involving sequential insecticide applications upon forest avifauna in the lower St. Lawrence region of Quebec.** *For. Pest. Manage. Inst. Rep. FPM-X* 34: 64 pp.; 1980 (4 references).

The effects of spruce budworm spraying operations on birds were studied in Canada. Three insecticides were applied sequentially: phosphamidon at 0.140 kg AI/ha, followed 3 days later by fenitrothion at 0.210 kg AI/ha, then 20 days later by aminocarb at 0.070 kg AI/ha. During a 2nd field operation, 3 different aircraft were used. Forest bird populations were monitored by plotting the location of all singing and sighted birds in established 10-ha plots. No dead birds were found, and no birds showed symptoms of pesticide poisoning (bill wiping, erratic flying, tremors, abnormal behavior). No major decline in population or activity resulted during the operation, and breeding territories remained occupied. The spray operations apparently had no immediate or short-term impact on forest birds.

81-2590. Gorbatsevskaya, E. F.; Osipova, M. A.; Ovsiannikova, L. M. (All-Union Res. Inst. Hyg. & Toxicol. Pestic. Polym. & Plast., Kiev, USSR) **Balans aminokislot pri autoimmunnykh protsessakh vyzvannykh deistveim na organizm γ-izomera geksakhlortsiklogeksana. [Amino acid balance in autoimmune processes caused by the γ-isomer of hexachlorocyclohexane.]** *Gig. Sanit.* 46(4): 24-26; 1981 (7 references) (Russian).

The effect of γ-hexachlorocyclohexane (HCCH; BHC; lindane) on amino acid balance was studied in rabbits. Animals received HCCH po, daily, at 4 mg/kg (0.02 LD50) for 3 mo or at 0.2 mg/kg for 6 mo. Chronic exposure to HCCH at 4 mg/kg caused a gradual decrease of the RBC count, with a simultaneous increase of anti-RBC and antiliver antibody titers. Development of autoimmune process was associated with imbalance of free amino acids in the blood serum. Exposure to HCCH at 2 mg/kg did not affect the pool of free amino acids, but induced formation of autoantibodies.

81-2591. Dyshlovoi, V. D.; Boiko, N. L.; Shemetun, A. M.; Kharchenko, T. I. (A. A. Bogomolets Med. Inst., Kiev, USSR) **Tsitogeneticheskoe deistvie tsiklogeksanona. [Cytogenic effect of cyclohexanone.]** *Gig. Sanit.* 46(5): 76-77; 1981 (9 references) (Russian).

The cytogenetic effect of cyclohexanone was studied in a culture of human peripheral blood lymphocytes. Lymphocytes were incubated with cyclohexanone at 0.1, 0.01 and 0.005 mg/l. The yield of chromosome aberrations (single fragments) showed a 2.2-4-fold increase compared with the frequency of spontaneous aberrations.

81-2592. Borzsonyi, M.; Surjan, A.; Pinter, A.; Torok, G.; Csik, M.; Tamas, J.; Fetter, J.; Ferencz, A. (Natl. Inst. Hyg., Budapest, Hungary) **Endogenous formation of N-nitrosomorpholine from a new fungicide.** *IARC Sci. Publ.* 31: 677-683; 1980 (5 references).

CFY male rats were divided into 4 groups of 10 animals each; 1 group served as a control. Animals in other

groups were treated with a single dose of 326.5 mg/kg trimorphamide ig; treated twice with sodium nitrite doses of 40 mg/kg ig; or treated with trimorphamide + sodium nitrite. All animals were sacrificed at 120 min. Dichloromethane was used to extract the nitroso derivative from the gastric content after steam distillation. Samples were analyzed by gas chromatography and mass spectrometry. *N*-nitrosomorpholine (NMOR) was identified, and the yield was determined to be 0.65%. By the Ames test, NMOR formed *in vivo* proved to be strongly mutagenic for the strains TA1535 and TA100, both in the presence and absence of S-9 fraction.

81-2593. Warzok, R.; Mendel, J.; Thust, R.; Schwartz, H.; Schneider, J. (Inst. Pathol., Prev. Oncol. Res. Group, Med. Acad., Erfurt, DDR) **Physico-chemical, mutagenic and carcinogenic properties of nitrosated urea herbicide metabolites.** *IARC Sci. Publ.* 31: 685-691; 1980 (11 references).

Alkylating activities, rates of decomposition, octanol/water partition coefficients and sister chromatid exchanges of several *N*-nitroso compounds, formed by nitrosation of pesticide metabolites or closely related substances, were determined. The biological activity of 1,3-disubstituted nitroso ureas is attributed to their instability in aqueous solutions under physiological conditions, giving an alkylating and carbamoylating moiety. The decomposition is a first order hydrolytic reaction. The rate of decomposition is determined by the substituents at the nitrogen atoms in the 1 and 3 positions. The phenyl group promotes hydroxyl ion attack, thus lowering the half-life. Striking differences are reported in the carcinogenic activity between NMPU and NMPU-Br. It is possible that the difference may be due to the extremely low water solubility of NMPU-Br.

81-2594. Ogata, M.; Hasegawa, T.; Mori, T.; Meguro, T. (Okayama Univ. Med. Sch., Okayama-shi, Japan) **Effects of chlorinated mono aromatic hydrocarbons on mitochondrial oxidative phosphorylation in rats liver.** *Ind. Health* 19(1): 31-36; 1981 (9 references).

Liver mitochondria were isolated from male Donryu rats. Oxygen uptake was measured in response to exposure to monochlorobenzene (MoCB); *o*-, *m*-, and *p*-dichlorobenzene (DiCB); 1,2,3-trichlorobenzene (TriCB); and 1,2,3,4-tetrachlorobenzene (TetCB). Respiratory control was strongly inhibited by TetCB and TriCB, with increasing state 4 respiration and decreasing state 3 respiration. The DiCB was less inhibitory than TriCB and TetCB, but was more inhibitory than MoCB. Potassium ion release from mitochondria was induced in the same order that respiratory control was inhibited. This suggests a possible interaction of potassium ion release with the mitochondrial membrane and induction of a change in permeability to ions. These chemicals probably act primarily as uncouplers of the mitochondrial oxidative phosphorylation rather than as an electron transport or an energy transfer inhibitor. The destructive effect of the chlorinated mono aromatic hydrocarbons on the mitochondrial membrane was also demonstrated by the potassium release.

81-2595. Buchet, J. P.; Lauwerys, R.; Roels, H. (Univ. Louvain, Unite Toxicol. Ind. Med., Clos Chapelle-aux-Champs, 30.54, B-1200 Bruxelles, Belgium) **Urinary excretion of inorganic arsenic and its metabolites after repeated ingestion of sodium metaarsenite by volunteers.** *Int. Arch. Occup. Environ. Health* 48(2): 111-118; 1981 (13 references).

Four volunteers were given oral doses of arsenic (125, 250, 500, or 1000 μg as $NaAsO_2$) once a day for 5 consecutive days. These individuals did not eat marine organisms during the study. Total arsenic, inorganic arsenic, monomethyl arsonic (MMA) and dimethylarsenic (DMA) acids were measured in urine samples collected at 24-hr intervals up to 14 days after the start of the experiment. The sum of inorganic arsenic, MMA, and DMA was very close to the urinary concentration of total arsenic determination after mineralization of the urine sample. These arsenicals may be the only metabolic forms of arsenic following absorption of inorganic arsenic. A steady-state in the urinary excretion of arsenic was reached within 5 days. The total amount of arsenic excreted in urine/day amounted to 60% of the ingested dose. Even with the oral daily dose of 1000 μg As for 5 days, the arsenic methylation capacity of the human body was not saturated. When arsenic administration was stopped, the biological half-life of arsenic in urine increased slightly with the dose from 39 hr at 125 μg to 59 hr at 1000 μg. A time-weighted average exposure of 50 μg As/m^3 would probably lead to an average urinary excretion of 200 μg As (sum of inorganic arsenic, MMA, and DMA)/g creatinine.

81-2596. Kasymov, A. G.; Velikhanov,, E. E.; Gasanov, V. M. (Inst. Zool., Minsk, USSR) **Vliyanie nekotorykh pestitsidov na vodnykh shivotnykh. [Effects of certain pesticides on aquatic fauna.]** *Izv. Akad. Nauk Az. SSR Ser. Biol. Nauk* (4): 92-95; 1981 (1 reference) (Russian).

The results of experimental evaluation of the toxicity of a number of pesticides for water animals are reported. Sevin (carbaryl) at 0.1 mg/l resulted in 50% mortality of shrimp; 1.0 mg/l was a lethal concentration. The LD50 of 2,4-dinitro-6-methylphenol (Arborol; DNOC) and monuron for shrimp was 10 mg/l. Zineb and dalapon at 10 mg/l caused a 100% mortality of shrimp. Butyphos (DEF), zineb, chlorophos, Sevin, and Arborol at 0.001-0.01 mg/l induced abnormalities in sturgeon fry. Sevin at 10 mg/l was lethal for sturgeon. The toxicity of dalapon and omnidel to fish was low.

81-2597. Nicholson, S. S.; Prejean, C. J. (Sch. Vet. Med., Louisiana State Univ., Baton Rouge, LA 70803) **Suspected 4-aminopyridine toxicosis in cattle.** *J. Am. Vet. Med. Assoc.* 178(12): 1277; 1981 (3 references).

A herd of 60 female Brahman cattle (2-3 yr old) drank water containing the bird repellent 4-aminopyridine, which had been used to treat rice seed. During a period of 36 hr, beginning 12-24 hr after gaining access to the poisoned water, half of the herd developed frequent passage of small amounts of feces and tenesmus, muscle tremors and incoordinated gait (pronounced in some animals), and complete anorexia that led to marked wt loss over several days. Behavioral changes were noteworthy. Three animals soon died. Necropsy of 1 cow did not reveal any lesions. Empirical treatment was given to 10 cows with injectable vitamin B complex and vitamins A, D, and E. When the owner indicated that organophosphate exposure might have occurred, atropine sulfate (120 mg) was given sc. Treatment did not alter the course of the toxicosis. Return of appetite and recovery occurred in survivors within 1 wk after onset.

81-2598. Duncan, C. J.; Greenaway, H. C.; Publicover, S. J.; Rudge, M. F.; Smith, J. L. (Dep. Zool., Univ. Liverpool, Liverpool L69 3BX, England) **Experimental production of septa and apparent subdivision of muscle mitochondria.** *J. Bioenerg. Biomembr.* 12(1-2): 13-33; 1980 (19 references).

After the application of A23187, caffeine, DNP (2,4-dinitrophenol), ruthenium red or lindane (50 μM) to the glycerinated and chemically skinned skeletal muscle fibers and cardiac muscle strips of both amphibians and mammals, the rapid formation (< 45 min) of internal septa has been observed. Rapid subdivision of mitochondria has also been noted *in situ*, and in some mitochondria, the 2 compartments are the same in configuration. In discussions of the significance of the mitochondrial septa, it is noted that there are many experimental procedures which promote rapid division of these organelles.

81-2599. Havercroft, J. C.; Quinlan, R. A.; Gull, K. (Biol. Lab., Univ. Kent, Canterbury, Kent CT2 7NJ, England) **Binding of parbendazole to tubulin and its influence on microtubules in tissue-culture cells as revealed by immunofluorescence microscopy.** *J. Cell Sci.* 49: 195-204; 1981 (27 references).

Increasing concentrations of parbendazole (2, 10, or 20 μM) progressively inhibited the assembly of microtubules in Vero cells, an established cell line derived from African Green Monkey kidney. Assembly of brain microtubules was inhibited by 50% with 3 μM, while virtually all assembly was inhibited by 10 μM parbendazole. Kinetics of inhibition were identical to those achieved with colchicine. Possible binding to tubulin was studied with highly purified mammalian brain tubulin and a maximum parbendazole concentration of 4 μM. Results indicate a specific binding of parbendazole to tubulin. A maximum binding value of 0.72 mol parbendazole/mol tubulin was established. Within 30 min after treatment of the Vero cells with parbendazole, microtubules had withdrawn from their normal places in the peripheral area of the cell. This early disassembly of the microtubule was associated with blebbing of the plasma membrane and increased levels of general diffuse fluorescence in the cell. Complete rounding up of the cells and further increases in cytoplasmic fluorescence were noted by 3-4 hr.

81-2600. Williams, S. E.; Wollum, A. G., II (Div. Plant Sci., Univ. Wyoming, Laramie, WY 82071) **Effects of cadmium on soil bacteria and actinomycetes.** *J. Environ. Qual.* 10(2): 142-144; 1981 (18 references).

Soybean fields amended for 3 yr with Cd at rates of 0, 6, 22 or 40 kg/ha were examined for soil procaryotic populations. Soil suspensions formulated from treated plots were planted on media containing increasing levels of Cd to determine if soil bacteria and actinomycetes tolerant to Cd had developed in Cd-treated soils. The level of DTPA-TEA extractable soil Cd had no effect on the development of Cd-tolerant soil procaryotes on Cd-amended media. Low Cd levels in the media slowed procaryote growth while high levels did not, regardless of the concentration of soil extractable Cd. At the time of sampling, soil moisture was found to be directly related to procaryote numbers on media containing 5 ppm Cd. All Cd concentration levels in the liquid media gave growth rate constants of 58 pure cultured bacteria. About 50% of the organisms were intolerant of 5 pm Cd, but tolerant of lower levels.

81-2601. Verma, S. R.; Rani, S.; Dalela, R. C. (Pollut. Relevant Res. Lab., Post Grad. Dep. Zool., D.A.V. Coll., Muzaffarnagar, India) **Effects of phenolic compounds on *in vivo* blood parameters of a fish *Notopterus notopterus*.** *J. Environ. Sci. Health B* 16(3): 273-282; 1981 (27 references).

Specimens of *Notopterus notopterus* were collected from neighboring fresh water sources and acclimated to the lab conditions for 5 days. The effects of phenol (P), dinitrophenol (DNP), and pentachlorophenol (PCP), singly and in various combinations, on blood parameters were studied. Concentrations were 0.1, 0.057, and 0.05 the 96-hr LD50 values. In general, red and white cell counts and packed cell volume increased after 30 days exposure; clotting time (CT), erythrocyte sedimentation rate, hemoglobin, mean corpuscular hemoglobin (MCH), MCH concentration, and mean cell volume (MCV) decreased after 30 days exposure. However, PCP exhibited a unique dual effect. Alone and in additive combination [(DNP + P)/PCP], CT and MCV decreased. CT and MCV increased in synergistic combination [(P + DNP)/PCP]. Hb increas-

ed in both the additive and synergistic combinations, and decreased in specimens exposed to PCP alone. These parameters can be used to indicate the deleterious effects of phenolic compounds in fish, an important source of human food.

81-2602. Shariatpanahi, M.; Anderson, A. C. (Dep. Environ. Health Sci., Sch. Public Health & Trop. Med., Tulane Univ., New Orleans, LA) **Effect of sodium arsenate on microbial growth in a chemostat.** *J. Environ. Sci. Health B* 16(3): 283-291; 1981 (7 references).

The effect of sodium arsenate on microbial cells using continuous flow cultures was studied to examine the effect of arsenate on the growth and maintenance requirements of the microbes. To determine the operating parameters of the chemostat, the generation times, specific growth rate, and maximum growth rates of the microbes were determined. For both *Corynebacterium* and *Pseudomonas*, the yield was lower at 100 μg/ml than at 10 μg/ml, by a factor of 8 for the former and 3 for the latter bacteria. At higher arsenate concentrations, however, the maintenance coefficient was 9-fold higher for *Corynebacterium* and 16-fold higher for *Pseudomonas*. These bacteria apparently used more energy for maintenance at the higher arsenate levels to adjust their physiology in response to environmental conditions, thereby having less energy available for cell production. Previous studies showed that these bacteria produced toxic metabolites from arsenate biotransformation that apparently stressed the cells. In this study the concentrations of metabolites were higher at the higher parent compound concentration. This further suggests the stressful environment of the cells and accounts for the additional energy expended in an attempt to maintain homeostasis.

81-2603. Sirois, J. C.; Peterson, E. A.; Miller, R. W. (Chem. Biol. Res. Inst., Agric. Canada, Ottawa, Ontario K1A OC6, Canada) **Potential effects of thiram on *Medicago R. meliloti* symbiotic association.** *J. Environ. Sci. Health B* 16(3): 293-307; 1981 (10 references).

The effects of 3 thiram preparations (recrystallized thiram, wettable powder formulation, and flowable thiram liquid formulation) on growth and respiration of rhizobia were tested. In liquid cultures the growth of *Rhizobium meliloti* was inhibited above 3.5 μg/ml with all 3 thiram preparations. However, even severely inhibited cultures (8.8 μg thiram/ml) recovered and approached full cell density after an initial lag period. The effect of the fungicide was primarily bacteriostatic. Although small amounts of thiram (0.88 μg/ml) produced noticeable growth inhibition of strain 102F70, this inhibition was overcome during the log phase of growth due to metabolism of the fungicide. All forms of thiram stimulated respiration rates in late log phase *R. meliloti* cells. At thiram levels > 1000 μg/ml, pure thiram stimulated germination and root elongation of Algonquin alfalfa seeds, but had no significant effect on Apollo seeds. Algonquin germination was increased but root elongation inhibited by formulated thiram. Effects of thiram on root growth coupled with bacteriostatic action may be partially responsible for poor nodulation by *R. meliloti* at high thiram levels. At fungicide concentrations recommended for seed application, only minor, temporary bacteriostasis was noted as a possible negative effect; germination rates of fungi-contaminated seed were markedly increased.

81-2604. Beaver, D. L. (Dep. Zool., Michigan State Univ., East Lansing, MI 48824) **Recovery of an American robin population after earlier DDT use.** *J. Field Ornithol.* 51(3): 220-228; 1980 (25 references).

The condition of the robin population at Michigan State University was investigated 17 yr after the last use of DDT at the university. The study was conducted from 2 April to 29 June 1979. The data demonstrate that no mortality due to DDT occurred by 1969, and that reproduction returned to pre-DDT levels by 1979. However, population size is still far below the estimated pre-DDT population of 336 birds. The data suggest that DDT has no detectable effect on clutch size in robins. The effect of DDT on the incubation of eggs and care of the nestlings appears to occur primarily through the death of the parents. During the years of maximum robin population depletion, a significant increase was also noted in the numbers of common grackle. Grackles appeared to be unaffected by DDT.

81-2605. Krishna Murti, C. R. (Ind. Toxicol. Res. Cent., Lucknow 226001, India) **Pesticides – models for the study of biochemistry of xenobiotics.** *J. Sci. Ind. Res.* 39(12): 725-733; 1980 (55 references).

Chemicals used in pest control have a wide range of chemical structures, from simple mixtures of copper, mercury, and arsenic salts to complex cyclic and polycyclic compounds. Molecular mechanisms of action are discussed for insecticides; herbicides, and fungicides. Organophosphate and carbamate insecticides act by inhibiting the active site of acetylcholine esterase, a neurotransmitter. Herbicides generally inhibit enzymes involved in photosynthesis. Fungicides act by chelating certain metal ions or interfere with fungal metabolism. Effects of these biocides in nontarget mammals may vary with the sex and general health of the organism. The major biotransformation reactions to which pesticides are subjected are dehydrohalogenation, dehalogenation, desulfuration, epoxidation, hydrolysis, hydroxylation, isomerization, *N*-desalkylation, *O*-desalkylation, oxidation, and reduction. The biodegradation of pesticides, particularly systemic pesticides that persist in the environment, needs further study.

81-2606. Grabowski, C. T. (Lab. Quant. Biol., Dep. Biol., Univ. Miami, Coral Gables, FL) **Plasma proteins and colloid osmotic pressure of blood of rat fetuses prenatally exposed to mirex.** *J. Toxicol. Environ. Health* 7(5): 705-714; 1981 (21 references).

Long-Evans rats were given mirex by gastric intubation at 6 mg/kg dose levels on gestation day 8.5 through 15.5. This dose was only moderately toxic to dams, noted by slightly reduced normal wt gain during pregnancy. On day 18.5 or 20.5 of pregnancy the dams were anesthetized by ip injection of 30 mg/kg sodium pentobarbital. No significant differences were noted between fetal and maternal plasma or between control and treated fetal plasma with respect to sodium and potassium concentrations or total osmolality. Treated fetuses had lower protein concentrations than non-treated controls. This effect was proportional to the degree of edema. The concentration in 20.5 day controls was 25.2 mg/ml; in mildly swollen treated fetuses, 18.1 mg/ml; and in severely swollen ones, 13.5 mg/ml. Quantitative and qualitative changes in plasma of affected fetuses were noted through studies with polyacrylamide gel electrophoresis. The colloid osmotic pressure was also reduced from 8.0 mm in controls and unaffected treated fetuses to 4.8 mm in swollen fetuses. It is concluded that lowered plasma protein and colloid osmotic pressure were responsible for mirex-induced fetal edema.

81-2607. Rastegaev, Yu. M.; Zabolotnyi, K. F. (All-Union Res. Inst. Vet Entomol. Aracnol., USSR) **Primenenie dietilbenzamida protiv gnusa i ovodov loshadei. [Use of diethylbenzamide against horse gnat and gadfly.]** *Khim. Sel'sk. Khoz.* 19(4): 46-47; 1981 (7 references) (Russian).

The use of diethylbenzamide (DEBA) against horse gnat and gadfly was studied. The residue and the rate of elimination were studied in 4 horses subjected to repeated spraying at 40 ml (8 g AI). Animals were sacrificed 1, 5, and 12 days after the treatment, and DEBA levels in the muscles, liver, lungs, kidneys, heart, and tongue were determined by gas-liquid chromatography. One day after spraying, DEBA was detected in the tongue (0.018 mg/kg) and in the muscles (0.005 mg/kg). On days 5 and 12, all organs and tissues were free of DEBA residues.

81-2608. Ziskind, L. A.; Roslavtseva, S. A. (All-Union Res. Inst. Chem. Means Plant Prot., USSR) **Chuvstvitel'nost' k pestitsidam klopa podizusa – khishchnika koloradskogo zhuka. [Sensitivity to pesticides of Colorado potato beetle predator *Podisus*.]** *Khim. Sel'sk. Khoz.* 19(4): 51-52; 1981 (6 references) (Russian).

The contact toxicity of the insecticides chlorofos (trichlorfon), dilor, and phthalofos (phosmet) and the fungicide polycarbazine to Colorado potato beetle and its predator *Podisus maculiventris* Say was studied. Chlorofos was found to be more toxic to the predator than to Colorado beetle (LC50. were 0.28 and 12.6 μg/g, respectively). Dilor toxicity to *Podisus* was low (195 μg/g, compared with 7.08 for Colorado beetle). The LC50 of phthalofos for *Podisus* and Colorado beetle were 4.61 and 3.0 μg/g, respectively. Polycarbazine was extremely toxic to *Podisus* larvae. The indexes of selectivity of chlorofos, dilor, and phthalofos were 0.02, 22.0, and 1.20, respectively.

81-2609. Mohn, G.; Philipp, E. M. (Dep. Physiol. Chem., Saarland, D-6650 Homburg/Saar, BRD) **Effects of *Syphacia muris* and the anthelmintic fenbendazole on the microsomal monooxygenase system in mouse liver.** *Lab. Anim.* 15(2): 89-95; 1981 (22 references).

Male and female C57BL/6N mice, previously treated with thibenzole to eliminate infection with *Syphacia muris*, were fed diets containing fenbendazole (0, 10, or 100 mg/kg/day) to prevent reinfection with the helminth. The effect of fenbendazole on the induction of the hepatic microsomal monooxygenase system by inhalation of cyclohexane or camphor was studied. Fenbendazole did not modify the natural P-450 system nor the effects of chemical inducers. Although absolute values of the enzyme activity decreased by 20-40% after chronic application of food containing fenbendazole, the specific induction values of experimental and control mice were the same found in similar mice infected with *S. muris*. Infection by *S. muris* accelerated the development of the hepatic monooxygenase system. Fenbendazole exerted neither a positive nor a negative effect on the hepatic microsomal P-450 system in adult mice.

81-2610. Moses, M.; Selikoff, I. J. (Monsanto Survey, Environ. Sci. Lab., Mount Sinai Med. Cent., New York, NY 10029) **Soft tissue sarcomas, phenoxy herbicides, and chlorinated phenols.** *Lancet* 1(8234): 1370; 1981 (6 references).

A case history is reported in which a worker, indirectly exposed to 2,4,5-T (and thus the contaminant TCDD), died of a soft tissue sarcoma. He had worked for a production plant for 32 yr, but never developed chloracne. This case raises the question of increased risk in workers indirectly exposed in production. It is important, in epidemiological studies, to include the population of workers with potential exposure, such as maintenance workers and truck drivers.

81-2611. Paschin, Y. V. (Inst. Gen. Genet., Acad. Sci. USSR, Moscow 117809, USSR) **Mutagenicity of maleic acid hydrazide for the TK locus of mouse lymphoma cells.** *Mutat. Res.* 91(4-5): 359-362; 1981 (7 references).

The mutagenic potential of maleic acid hydrazide (MAH) was evaluated on the basis of estimation of for-

ward mutant frequencies from TK-competency to TK-deficiency. The modified method of Chu and Fischer for cloning L5178Y cells in soft agar gel suspension was employed after a 48-hr expression time following mutagenicity treatment. Preliminary experiments for the detection of cytotoxic effects of a 2-hr treatment with different concentrations of MAH for TK-competent cells were made. From these cytotoxicity data $1.0\text{-}2.2 \times 10^{-2} M$ MAH was used for mutagenicity testing. Concentrations < 0.01 *M* showed no apparent toxic acuivity. MAH demonstrated mutagenic activity in a dose range of 160-220 *M*, and under these conditions post-treatment with caffeine did not increase the induction of forward mutations at the TK locus.

81-2612. deJager, A. E. J.; van Weerden, T. W.; Houthoff, H. J.; de Monchy, J. G. R. (Dep. Neurol., Acad. Ziekenhuis, Groningen, The Netherlands) **Polyneuropathy after massive exposure to parathion.** *Neurology* 31(5): 603-605; 1981 (20 references).

A 41-yr-old farmer attempted suicide by drinking 25% solution of parathion in methyl alcohol (estimated parathion dosage 150 g). On admission, he was apneic, hypothermic, and in shock. During the next days he was treated with obidoxime (1075 mg the first 3 days) and atropine (44.5 mg the first day, average 30 mg/day over the next 2 wk). Charcoal perfusions and exchange transfusions were performed. After 7 wk in a coma, he recovered but exhibited flaccid paralysis of both legs and weakness of the muscles of both hands. His condition gradually improved; after 1 yr he no longer used leg braces and was doing farm work. The incidence of delayed polyneuropathy after suicidal ingestion of parathion is believed to be rare.

81-2613. Yanchinski, S. (Author address not given) **Must Botswana's wildlife give way to cattle?** *New Sci.* 89(1243): 598-600; 1981.

A proposed tsetse fly control program for the Okovanggo delta in Botswana is discussed. The program would involve ultra-low volume (ULV) spraying of the insecticide endosulfan. Concern is voiced about the impact of the proposed program on the wildlife of the Okovanggo delta. Elimination of the tsetse fly would allow development of the beef industry in the area, and subsequent elimination of wildlife habitats. The toxic effects of endosulfan on wildlife are also considered. Application of endosulfan at traditional levels has resulted in death of large numbers of birds and fish in Nigeria. Tests of ULV spraying in the Okovanggo delta have resulted in 5-6% mortality of fish. Abnormal fish behavior, which attracted fish-eating birds and scavengers, was also noted for several days after spraying.

81-2614. Oshima, K.; Kitamura, M.; Onozawa, T.; Kozukue, H. (Sch. Hyg., Jikei Med. Coll., Tokyo, Japan) **[Experimental examination on the appearance of punctate basophilic erythrocytes and activity of pyrimidine 5′-nucleotidase. 2. In the cases of administration of antimony, arsenic and DDT, respectively.]** *Nippon Eiseigaku Zasshi (Jpn. J. Hyg.)* 36(1): 438; 1981 (1 reference) (Japanese).

Male rabbits were given antimony (Stibnal, 5 ml/kg), arsenic acid (As 2.64 mg/kg), or DDT emulsive concentrate (20%, 3 ml/kg). The presence of punctate basophilic erythrocytes (BSE) and of reticulocytes was determined, and activities of pyrimidine 5′-nucleotidase and of ALAD were measured. In the rabbit administered Stibnal, BSE appeared 3 days after exposure; although BSE levels increased at first, they decreased at 8 days and disappeared 14 days after administration. No large fluctuation of pyrimidine-5′-nucleotidase and ALAD or reticulocytes were observed. In rabbits given arsenic acid, BSE appeared from 5 to 15 days after exposure; no large fluctuations of pyrimidine 5′-nucleotidase, ALAD, or reticulocytes were observed. In rabbits given DDT, BSE appeared 3-19 days after exposure; no large fluctuations of pyrimidine 5′-nucleotidase, ALAD, or reticulocyte were observed.

81-2615. Ando, M.; Wakisaka, I. (Dep. Environ. Sanit., Natl. Inst. Environ. Pollut., Japan) **[Relationship between the concentration of lipids in the liver and the concentrations of DDT and its metabolites in the liver.]** *Nippon Eiseigaku Zasshi (Jpn. J. Hyg.)* 36(1): 439; 1981 (1 reference) (Japanese).

The relationships among residual concentrations of DDT, DDD (TDE), and DDE in rat liver, the concentrations of each lipid component in the liver, and the concentration of protein and fat in the diet of the rats were examined. Results were arranged in the following second order regression formula: $\ln(DDT) = -0.0488x_1 + 0.0429x_2 + 0.00059x_1^2 - 0.00037x_2^2 + 4.782 - 0.00057x_1x_2 + 0.621 \ln(TLP) - 0.134 \ln(PL)$, where ln represents natural logarithm, x_1 represents the content of of protein in the diet; and x_2 represents the content of fat in the diet. Similar relationships were divided for TDE and DDE concentrations in the liver.

81-2616. Yamanaka, S.; Nishimura, M. (Sch. Hyg., Tokyo Dent. Coll., Tokyo, Japan) **[Effects of organophosphorus pesticides on the cholinesterase activity in the internal organs of rat.]** *Nippon Eiseigaku Zasshi (Jpn. J. Hyg.)* 36(1): 445; 1981 (1 reference) (Japanese).

Fenitrothion (170 mg/kg) and pyridaphenthion (400 mg/kg; 0.5 LD50) were administered orally to male Wistar rats. After 1, 3, 6, 24, and 48 hr, blood was sampled under ether-anesthesia, and the liver, kidney, brain, lung, parotid gland, and submaxillary glands were extirpated. PAM (100 mg/kg) and atropin sulfate (17 mg/kg) were administered simultaneously with the organophosphorus

pesticides in some animals. Activity of cholinesterase (ChE) was determined in homogenates the extirpated organs and in the serum from the collected blood. In fenitrothion treated rats, the change of ChE activity in the organs (except for liver) and in serum was almost the same, showing a 50% reduction 1 hr after administration, minimum levels after 24 hr, and recovery after 48 hr. In pyridaphenthion treated rats, the change of ChE activity was different by organ, showing a reduction in serum and erythrocytes 1 hr after administration; however, in brain, there was a sudden reduction after 6 hr corresponding to the appearance of toxic symptoms. The reduction of ChE activity in the organs continued more than 48 hr. Atropin sulfate did not affect the ChE activity of all organs, PAM strongly affected ChE activity in serum and erythrocyte, and pyridaphenthion noticeably affected ChE activity in the lung, liver, and parotid gland.

81-2617. Yamauchi, T.; Konno, N.; Kinebuchi, H. (Sch. Public Health, Fukushima Prefect. Med. Coll., Fukushima, Japan) **[Delayed-type neurotoxicity of an organophosphorus insecticide, phosvel, painted onto cockscomb.]** *Nippon Eiseigaku Zasshi (Jpn. J. Hyg.)* 36(1): 446; 1981 (1 reference) (Japanese).

Phosvel (leptophos, 34%) emulsive concentrate was painted on both sides of the comb of 6-mo-old roosters and on 24-mo old hens (0.5 ml/application, 2 times/day for 5, 10, 15, and 20 consecutive days). No roosters painted for 5 consecutive days showed nervous disorders. However, all roosters painted for 10 consecutive days showed neurotoxic symptoms; 4 developed severe paralysis and 2 died by respiratory paralysis 20 and 21 days after the last painting. Two of 5 adult hens painted for 5 days, 4 of 5 adult hens painted for for 10 days, and all adult hens painted for 15 days or 20 days showed nervous disorders; 1 hen painted for 15 days and 2 hens painted for 20 days died 23, 16, and 7 days after the last application. Acetone solution of purified leptophos (17%) was painted on both sides of the comb (1 ml/application, 2 times/day for 10 consecutive days). Four of 5 hens showed nervous disorders; the occurrence of delayed neurotoxicity was about the same as in the previous experiment. The hen painted with acetone only showed no abnormality. No relationship was seen between the number of days of exposure to leptophos and reduction in body wt.

81-2618. Konno, N.; Yamauchi, T.; Kinebuchi, H. (Sch. Public Health, Fukushima Prefect. Med. Coll., Fukushima, Japan) **[Delayed-type neurotoxicity of an organophosphorus insecticide, cyanofenphos, painted onto cockscomb.]** *Nippon Eiseigaku Zasshi (Jpn. J. Hyg.)* 36(1): 447; 1981 (1 reference) (Japanese).

Malathion (50%) or cyanofenphos (25%) emulsive concentrates were painted on to both sides of the combs of 2-yr-old hens (0.5 ml/day for 10 and 15 consecutive days). Cyanofenphos was also painted on combs of hens (1, 2, 3, and 4 times/day for 5 consecutive days). One of 5 hens painted for 10 days with cyanofenphos and one of 5 hens painted for 15 days with malathion died of acute toxicity. Four of 5 hens painted for 15 days showed symptoms of delayed nervous disorders. One of 5 hens painted 2 times/day for 5 days and 3 of 5 hens painted 4 times/day for 5 days showed symptoms of delayed nervous disorders. Cyanofenphos caused delayed neurotoxicity at about 800-1600 mg/kg when painted on the combs of hens; toxicity was 0.25-0.125 the toxicity induced by forced oral administration. Absorption of cyanofenphos via the comb is limited. The method of painting a test substance on the comb of domestic fowl is a useful screening method for detecting delayed neurotoxicity.

81-2619. Ohba, M.; Ito, H.; Ohta, H.; Shibata, T.; Shikano, M.; Fukaya, T.; Ohkubo, M.; Sasa, H.; Niwa, T.; Matsui, E. (First Dep. Intern. Med., Ohgaki Citizens' Hosp., Ohgaki, Gifu, Japan) **[Two cases of intoxication due to paraquat dichloride. The change of morbid state of the cases.]** *Nippon Naika Gakkai Zasshi (J. Jpn. Soc. Intern. Med.)* 70(4): 595; 1981 (Japanese).

A 43-yr-old woman attempted suicide by swallowing 1 g of 24% paraquat dichloride herbicide, and was hospitalized by hematemesis with disturbances on the liver and lungs. After dialysis, the patient showed signs of recovery; however, an interstitial image appeared in radiographs of the left lung 5 days after paraquat ingestion, and the change progressed. Contraction of the left lung occurred on day 46. Conspicuous fibrosis was detected by biopsy. The patient subsequently left the hospital and was lost to followup. A 18-yr-old woman who attempted suicide by swallowing 0.2 cup of 24% paraquat dichloride was hospitalized on the 2nd day. In spite of blood irrigation, she suffered from disturbances of liver and kidney, followed by respiratory failure. She died on day 14 after ingestion.

81-2620. Kaneko, H.; Ohkawa, H.; Miyamoto, J. (Res. Dep., Pestic. Div., Sumitomo Chem. Co. Ltd., Takarazuka, Hyogo, Japan) **Absorption and metabolism of dermally applied phenothrin in rats.** *Nippon Noyaku Gakkaishi (J. Pestic. Sci.)* 6(2): 169-182; 1981 (10 references).

Absorption and metabolism of ^{14}C-8(+)-*trans*]-phenothrin (0.2 mg/animal) and ^{14}C-[(+)-*cis*]-phenothrin (2 mg/animal) dermally administered to male rats in the form of dust or emulsifiable concentrate (EC) were studied. The absorption of the ^{14}C into the body was estimated to be 3-7% of the initial dose when applied as dust and 8-17% when applied as EC. The rate of absorption of ^{14}C was 4-5 times faster with EC than with dust; the half-life of ^{14}C in the blood was 2-3 times longer with EC than with dust. The ^{14}C absorbed through the skin was

almost completely excreted into urine and feces within 6 days after administration. Residual ^{14}C in tissue was very low, except for the treated location on the skin. When administered once orally, at the rate of 2 mg/rat (either isomer), about 96% of the dose was recovered in the excreta during the following 6 days. With the [(+)-*cis*]-isomer, a larger amount of ^{14}C was excreted in feces and with the [(+)*trans*]-isomer a larger amount was excreted in urine. Nearly the same metabolites were obtained in oral and dermal administration with either isomer, although the nature and amount of the metabolites were different. The major metabolites from the [(+)-*trans*]-isomer were 3-phenoxybenzoic acid and its glycine conjugate and (3-4′-hydroxyphenoxy)benzoic acid and its sulfate. The *cis*-isomer gave larger amounts of ester metabolites.

81-2621. Mihara, K.; Ohkawa, H.; Miyamoto, J. (Res. Dep., Pestic. Div., Sumitomo Chem. Co. Ltd., Takarazuka, Hyogo 665, Japan) **Metabolism of terallethrin in rats.** *Nippon Noyaku Gakkaishi (J. Pestic. Sci.)* 6(2): 211-222; 1981 (15 references).

^{14}C-Terallethrin (*dl*-3-allyl-2-methyl-4-oxo-2-cyclopentenyl 2,3,3,3-tetramethylcyclopropane- 1-carboxylate, labelled in carbonyl group in the acidic moiety) administered once po or sc to male or female Sprague-Dawley rats at a rate of 5 mg/kg was traced. The ^{14}C was rapidly absorbed into the rat body and distributed to the intestine, liver, kidney, and other organs, and then rapidly excreted out of the body. Recovery 0-2 days after administration was 48.2-59.8% in urine, 35.9-47.1% in feces, and 95.2-97.6% in total. Recovery 0-7 days was 96.8-100.1%. Residual ^{14}C in main organs in male and female 7 days after administration corresponded to 0.09 mg terallethrin/g of tissue. ^{14}C-metabolites excreted in urine and feces consisted of at least 18 compounds, and the parent compound was identified in an amount of 0.2-0.3% in feces. The main metabolite was the product of oxidation of the gem-dimethyl group and cleavage of the carboxyl ester linkage. A compound having the 2-methyl group in the allethronyl moiety hydroxymethylated and a compound having the 3-allyl group hydroxylated were identified as the metabolites. The amounts of metabolites having a gem-dimethyl group hydroxylated or a 3-allyl group hydroxylated were larger in male rats than female rats. The level of a metabolite having the gem-dimethyl group oxidized to a carboxyl group was larger in female than in male rats.

81-2622. Hashimoto, Y.; Nishiuchi, Y. (Natl. Agric. Chem. Insp. Stn., Kodaira, Tokyo, Japan) **[Establishment of bioassay method for the evaluation of acute toxicity of pesticides to aquatic organisms.]** *Nippon Noyaku Gakkaishi (J. Pestic. Sci.)* 6(2): 257-264; 1981 (27 references) (Japanese).

Acute toxicity of previously registered pesticides to carp and daphnia was evaluated, and factors influencing the toxicity of pesticides or sensitivity of test organisms to pesticides were investigated. Rotenone and organochlorine insecticides, organomercurials, organotin, dimethyl dithiocarbamate and phthalimide fungicides, and dinitrophenol and pentachlorophenol (PCP) herbicides are highly toxic to carp. Organophosphorus and phenylcarbamate insecticides are extremely toxic to daphnia. Toxicity to carp was in the order emulsifiable concentrates > technical products > wettable powders > dusts and granules. The majority of pesticides are more toxic to carp and daphnia at higher temperatures. However, folpet and DDT are less toxic at higher temperatures. The majority of pesticides are less toxic at higher pH. No apparent synergism or antagonism is observed to occur between 6 pairs of organophosphorus and phenyl carbamate insecticides with carp. No remarkable change is observed in sensitivity of carp growth to 6 pesticides, including organophosphorus insecticides and the herbicide pentachlorophenol, although sensitivity to endosulfan is extremely high at earlier developmental stages. Dietary pesticides are generally less toxic to carp than pesticides added to water. The sensitivity of other aquatic organisms to pesticides was evaluated by a recently developed method. Gold fish, *Rhodeus moriokae, Misgurnus anguillicaudatus* and *Oryzias latipes* show sensitivity similar to carp. Larvae of *Orthetrum albistylum speciosum* and of *Cloeon dipterum* are less sensitive than daphnia. The sensitivity of the mollusks tested and tadpoles of *Bufo bufo japonicus, Rana brevipoda* and *R. catesbeiana* to pesticides was found to be low.

81-2623. Tagatz, M. E.; Ivey, J. M.; Oglesby, J. L. (US EPA, Environ. Res. Lab., Gulf Breeze, FL) **Toxicity of drilling-mud biocides to developing estuarine macrobenthic communities.** *Northeast Gulf Sci.* 3(2): 88-95; 1979 (9 references).

Various biocides used in drilling muds for offshore oil explorations were studied for their effects on macrobenthic communities developing from planktonic larvae in treated and untreated aquaria. The abundance of animals decreased significantly after exposure to Surflo-B33, but not to Aldacide. Average numbers of individuals and species/aquarium were significantly less in aquaria receiving 819 μg/l. Significantly fewer chordates, mollusks, and annelids occurred at 819 μg/l. Mollusks were the most sensitive and their abundance was significantly reduced even at the 41 μg/l level. The higher toxicity of the chlorophenols tested indicated that the use of alternative biocides such as paraformaldehyde should be considered for natural waters.

81-2624. Ikema, S. (Lab. Environ. Pollut., Okinawa Prefect. Inst. Public Health, Osata, Okinawa, Japan) **[Accumulation of organophosphorus insecticide in fish body and its decline with the putrefaction of fish body.**

Part II.] *Okinawa-ken Kogai Eisei Kenkyushoho (Annu. Rep. Okinawa Prefect. Inst. Public Health)* 14: 17-18; 1981 (1 reference) (Japanese).

The decline of phenthoate levels in the body of grey mullet with putrefaction of the body was traced using 3 fishes which died of phenthoate toxicity. The fish muscle was homogenized and left in a beaker at room temperature covered with a gauze for detection of phenthoate. The amount of phenthoate was 0.7, 0.7, 0.7, 0.6, 0.4, 0.2, 0.2, and trace amounts, respectively, on days, 0, 1, 2, 3, 4, 7, 10 and 12. Phenthoate which had accumulated in the fish body remained at about 29% of the original level.

81-2625. Pimprikar, G. P.; Georghiou, G. P. (Div. Toxicol. & Physiol., Univ. California, Riverside, CA 92521) **Mechanisms of resistance to diflubenzuron in the house fly, *Musca domestica* (L.)** *Pestic. Biochem. Physiol.* 12(1): 10-22; 1979 (16 references).

A diflubenzuron-selected strain of the house fly with > 1000-fold resistance was used to study the mechanism of resistance to the chitin synthesis inhibitor diflubenzuron. An OMS-12-selected strain with 380-fold resistance to diflubenzuron was also used. Chitin synthesis was reduced less in larvae of the resistant (R) strains than of a susceptible (S) strain. Cuticular penetration of diflubenzuron into larvae of the R strains was about half that found in S strains. Both piperonyl butoxide and sesamex synergized diflubenzuron markedly in the R strains. This indicated that mixed-function oxidase enzymes played a major role in resistance. Limited synergism of S,S,S-tributyl phosphorotrithioate and diethylmaleate indicated that esterases and glutathione-dependent transferases played a relatively small role in resistance. Larvae of the S and R strains exhibited a similar pattern of *in vivo* cleavage of diflubenzuron at N1-C2 and N1-C1 bonds. There were, however, marked differences in the amounts of major metabolites produced. R larvae metabolized diflubenzuron at higher rates, leading to an 18-fold lower accumulation of unmetabolized diflubenzuron than S larvae. Polar metabolites were excreted at a 2-fold higher rate by R larvae. The combined effects of reduced cuticular penetration, increased metabolism, and rapid excretion of the chemical produce the high level of resistance to diflubenzuron in R-diflubenzuron and R-OMS-12 larvae.

81-2626. Patil, T. N.; Telford, J. N.; Plapp, F. W.; Koch, R. B. (Dep. Biochem., Mississippi State Univ., Mississippi State, MS 39762) **Isolation, characterization, and properties of factor F_1 from mitochondrial preparations of housefly (*Musca domestica* L.) thorax.** *Pestic. Biochem. Physiol.* 12(1): 95-104; 1979 (31 references).

The effect of various pesticide compounds on the activity of the water-soluble unit (F_1) of Mg^{2+}-dependent ATPase isolate from housefly (*Musca domestica* L.) thorax mitochondria was studied. The ATPase comprised about 14% of the proteins from a crude preparation. Homogeneity of the F_1 preparation was assessed by gel electrophoresis, isoelectric focusing, and electron microscopy. This preparation consisted of 5 subunits, 17,500 to 68,000 molecular wt. The isoelectric pH of the protein was 7.3. F_1 had a pH optimum of 8.2 and a temperature optimum between 37 and 45°C. At 25°C the enzyme was fairly stable. At 0°C almost all activity was gone. Low concentrations of 2,4-dinitrophenol stimulated F_1 activity. Azide, *p*-hydroxymercuribenzoate, and guanidine hydrochloride inhibited the enzyme. Oligomycin and the pesticides pyrethrin, cyhexatin, and DDT had no effect on the enzyme activity, although all of these chemicals inhibit intact Mg^{2+}-ATPase. DDT may act on F_1 when it is in association with one or more membrane component(s).

81-2627. Chopade, H. M.; Dauterman, W. C. (Toxicol. Program, Dep. Entomol., North Carolina State Univ., Raleigh, NC 27650) **Studies on the *in vitro* metabolism of methidathion by rat and mouse liver.** *Pestic. Biochem. Physiol.* 15(2): 105-119; 1981 (41 references).

The *in vitro* degradation of methidathion was studied in rat and mouse liver to determine the metabolic pathway of this insecticide in mammalian liver. The major route of metabolism in rat and mouse liver was via glutathione S-transferases, and the predominant metabolite was desmethyl methidathion. The mixed-function oxidase system was involved in the metabolism of methidathion also. Four water-soluble metabolites were characterized: desmethyl methidathion; the glutathione conjugate of the heterocyclic moiety of methidathion; the cysteinylglycine conjugate; and the cysteine conjugate. Chloroform-soluble metabolites identified included the oxygen analogue of methidathion and methoxythiadiazolin. When the P—S bond is cleaved, the 3-(mercaptomethyl)-5-methoxy-1,3, 4-thiadiazol-2(3H) -one is formed; this intermediate undergoes S-methylation in plants and animals to form the sulfide, which undergoes oxidation to form the sulfoxide and subsequently the sulfone. Desmethyl methidathion and the sulfone underwent no additional degradation. Thioether oxidation of the sulfide to the sulfoxide was found to be the major reaction mediated by the FAD-dependent monooxygenase system. However, oxidation of the sulfoxide to the sulfone was mediated by the mixed-function oxidase system and appeared to be a minor pathway. The *in vitro* metabolism of methidathion by rat and mouse liver was similar with a few quantitative interspecies differences.

81-2628. Chadwick, R. W.; Copeland, M. F.; Mole, M. L.; Nesnow, S.; Cooke, N. (Environ. Res. Cent., US EPA, Research Triangle Park, NC 27711) **Comparative effect of pretreatment with phenobarbital, Aroclor 1254, and β-naphthoflavone on the metabolism of lindane.** *Pestic. Biochem. Physiol.* 15(2): 120-136; 1981 (53 references).

Female Sprague-Dawley rats (30) were fed diets containing either 500 ppm Aroclor 1254, 356 ppm phenobarbital, or 418 ppm β-naphthoflavone. All animals were dosed 1 wk later with 1.89 mg lindane (1.63 μCo [U-^{14}C]-labeled). After 24 hr, rats were sacrificed, and samples of urine, feces, expired air, fat, liver, and kidney were taken for analysis of radioactivity. Rats pretreated with Aroclor 1254 or phenobarbital had excreted 82.8 and 77.7%, respectively, of the lindane dose in urine, feces, and expired air. Rats pretreated with either Aroclor 1254 or phenobarbital exhibited urinary radioactivity approximately 4 fold greater than rats pretreated with β-naphthoflavone or rats that were not pretreated Aroclor 1254 pretreatment produced a 7 fold increase in the radioactivity expired by controls. Results from this study suggest that pretreatment with phenobarbital, Aroclor 1254, or β-naphthoflavone significantly altered the excretion pattern of lindane and its metabolites through rather selective effects on the multiple pathways involved in the biotransformation of the insecticide.

81-2629. Mahmood, A.; Agarwal, N.; Dudeja, P. K.; Sanyal, S.; Mahmood, R.; Subrahmanyam, D. (Dep. Biochem., Postgrad. Inst. Med. Educ. Res., Chandigarh 160012, India) **Effect of a single oral dose of DDT on intestinal uptake of nutrients and brush border enzymes in protein – calorie-malnourished monkeys.** *Pestic. Biochem. Physiol.* 15(2): 143-148; 1981 (25 references).

Rhesus monkeys were maintained on protein- and calorie-deficient diets and given a single oral dose of 150 mg DDT/kg body wt. Uptake of alanine and phenylalanine were inhibited, and activities of sucrase, lactase, and leucine aminopeptidase were depressed. Alkaline phosphatase activity was not affected under these conditions. Nutrient uptake and disaccharidase activity were elevated in undernourished animals. Changes in protein, sialic acid, and phospholipid fractions of microvillus membrane brush borders were noted in the malnourished and pesticide-exposed, malnourished animals. Membrane cholesterol and triglyceride contents were not different in protein-energy deficient, DDT-fed monkeys.

81-2630. Sudershan, P.; Khan, M. A. Q. (Res. Dep., Illinois State Psychiatr. Inst., Chicago, IL 60612) **Metabolism of ^{14}C-dieldrin in bluegill fish.** *Pestic. Biochem. Physiol.* 15(2): 192-199; 1981 (22 references).

Bluegill fish (*Lepomis macrochirus*) were exposed to 50 ppb of ^{14}C-labeled dieldrin (300 μg in 6 *l*, 1 fish/jar. At the end of 48 hr, fish were transferred to dieldrin-free water to observe the elimination of radioactivity; water changes were made every 8 days, to a total of 23 days, when fish were frozen for later analysis. Approximately 73% of the radiocarbon present in exposure jars was picked up by the fish. Only 16.20% of the absorbed radioactivity was eliminated in the 23-day period following transfer to clean water. TLC/autoradiography of the recovered material revealed 9 radioactive spots, which included unchanged dieldrin (74.39%), pentachloroketone (8.17%), and aldrin-trans-diol (8.04%) as the major metabolites. Ether extract of the combined viscera from 4 fish resulted in the recovery of 15.65% of the absorbed radioactivity, 13.42% of which was due to dieldrin, and 1.38% to the ketone derivative.

81-2631. Spokes, J. R.; Macdonald, R. M.; Hayman, D. S. (Soil Microbiol. Dep., Rothamsted Exp. Stn., Harpenden, Herts. AL5 2JQ, England) **Effects of plant protection chemicals on vesicular – arbuscular mycorrhizas.** *Pestic. Sci.* 12(3): 346-350; 1981 (15 references).

The effects of 8 plant protection chemicals (aldicarb, chlorfenvinphos, chlorotoluron, benomyl, drazoxolon, triadimefon, etridiazole and chloroneb) on the development of vesicular-arbuscular mycorrhizas were influenced by the identity of the host plant and fungal endophyte, the soil type, and the composition and concentration of the biocide. These effects ranged from stimulatory (as with the fungicide chloroneb, applied to inocula of *Glomus microcarpus* used with pot-grown lettuce), through negligible (aldicarb on *G. mosseae* in pot-grown onions and field-grown barley with indigenous mycorrhizal fungi) to short-term inhibition (drazoxolon on *G. mosseae* in onion) and longer term inhibition (the fungicides benomyl and triadimefon on *G. mosseae* in onion). (Author abstract by permission)

81-2632. Mahapatra, R. N.; Rao, V. R. (Div. Soil Sci. & Microbiol., Cent. Rice Res. Inst., Cuttack 753006, India) **Influence of hexachlorocyclohexane on the nitrogenase activity of rice rhizosphere soil.** *Plant Soil* 59(3): 473-477; 1981 (20 references).

A field experiment was conducted to evaluate the relative influence of HCH (BHC) during the dry season on a typical alluvium soil which was submerged throughout the growing period. Commercial formulations of HCH at 0, 0.5, 1, 2.5, and 5 kg AI/ha were applied to field soil before submergence and 20 day old seedlings of rice cultivars were transplanted. Three plants from each plot were uprooted on days 66, 73, 80, and 87 after transplantation and prepared for nitrogen fixation studies. HCH at 2.5 kg and 5 kg dosage levels was inhibitory to the rhizosphere soil nitrogenase activity. In fact, nitrogen fixing activity was more pronounced in rhizosphere soil samples from HCH-treated fields than from untreated fields. Application of HCH at 1 and 2.5 kg levels exhibited a uniform stimulatory effect throughout almost the entire growing period of the rice plant. The increase caused by the 5 kg AI/ha dose level was not as profound as at the lower levels of insecticide application. Application of HCH was then made to 3 groups of heterotrophic bacteria in the rhizosphere soil. Results showed substantial stimulation of

the population of nitrogen-fixing *Azospirillus* sp. and *Azotobacter*, while anaerobic nitrogen fixers were not markedly affected. Evidently the stimulation of nitrogen fixation in HCH treated soils could be due to the enhancement of nitrogen-fixing heterotrophic microorganisms and creation of favorable redox-potential for their activity.

81-2633. El-Begearmi, M. M.; Ganther, H. E.; Sunde, M. L. (Dep. Poult. Sci. & Nutr. Sci., Univ. Wisconsin, Madison, WI 53706) **Toxicity of mercuric chloride in Japanese quail as affected by methods of incorporation into the diet.** *Poult. Sci.* 59(10): 2216-2220; 1980 (3 references).

Mercuric chloride added to the diets of 1-day old Japanese quail produced a greater mortality than when added as a solution or a casein-premix. At 4 wk, average mortalities were 85, 55, and 33% when 500 ppm mercury as $HgCl_2$ was added dry, in 95% ethanol, or as a casein premix, respectively. The type of solvents used had little or no effect on mortality. Mercury as a $HgCl_2$-casein premix caused the lowest mortality and increased levels of mercury in the kidney. These decreased mortalities were independent of reduced mercury absorption. It was suggested that the solvent could facilitate the binding of mercury to a feed component, thereby affecting the mercury availability.

81-2634. Kubena, L. F. (Vet. Toxicol. & Entomol. Res. Lab., Agric. Res., SEA, USDA, College Station, TX 77841) **The influence of diflubenzuron and several weight characteristics in growing male broiler and layer chickens.** *Poult. Sci.* 60(6): 1175-1182; 1981 (9 references).

Diflubenzuron (Dimilin, TH-6040; *N*-[[(4-chlorophenyl) -amino]carbonyl]- 2,6-difluorobenzamide) was fed to male broiler and layer chickens at levels of 0, 2.5, 25, and 250 ppm from 1 day to 98 days of age. Characteristics measured were body wt, g feed/g body wt, testes wt, liver wt, comb wt, and feet wt. There were no consistent significant differences among the control, 2.5, 25, or 250 ppm groups in any of the characteristics measured. There was a trend for higher body wt in the chickens fed diets containing diflubenzuron. (Author abstract by permission)

81-2635. Tavmuradov, Kh. T.; Volkova, N. V. (Dep. Pathophysiol., I.P. Pavolv Med. Inst., Camarkand, USSR) **Legochiyi syrfaktant i okislitel'noe fosforilirovanie v mitokhandriyakh legkikh pri eksperimental'nom tuberkuleze na fone otravleniya geksakhloranom. [Pulmonary surfactant and oxidative phosphorylation in lung mitochondria during experimental cavernous tuberculosis in the presence of hexachlorane poisoning.]** *Probl. Tuberk.* (4): 57-61; 1981 (22 references) (Russian).

Activity of pulmonary surfactant and oxidative phosphorylation in lung mitochondria was studied in dogs that had experimental cavernous tuberculosis and/or were exposed to hexachlorane (BHC). Animals were exposed to hexachlorane at 0.02 LD50 and 0.002 LD50 (30 and 3 mg/kg, respectively) for 81 or 111 days. The dogs exposed to hexachlorane had a more severe disease course and more severe manifestations of tuberculosis (prevalence of exudative component of the inflammation and earlier dissemination of the disease). There was a marked inhibition of pulmonary surfactant both in the involved and in the contralateral lung lobe. Hexachlorane poisoning caused marked uncoupling of oxidative phosphorylation and marked inhibition of its intensity in mitochondria isolated from the tuberculosis locus and from the contralateral lung.

81-2636. Kaai, K.; Mitsueda, J.; Shimizu, S.; Hasegawa, H.; Sato, M. (Natl. Inst. Ind. Med., Kawasaki, Kanagawa, Japan) **[Pathological examination of inhalation toxicity of 1,2-dibromo-3-chloropropane (DBCP).]** *Sangyo Igaku Sogokenkyusho Nempo (Annu. Rep. Natl. Inst. Ind. Med.)* p. 18; 1979 (Japanese).

Male rats were exposed to air containing 0.3, 1, 3, and 10 ppm 1,2-dibromo-3-chloropropane (DBCP) for 2 wk. Histopathological examination of the rats exposed to 10 ppm DBCP revealed testicular atrophy as well as denaturation, necrosis, and abnormal regeneration of the epithelium of proximal kidney tubules and the epithelium of the bronchus, emphysematous dilation of the pulmonary parenchyma, and bone marrow atrophy. The degree of testicular atrophy paralleled the concentration of DBCP in the inhaled air. Pathological changes were clearly observed in the group exposed to 1 ppm DBCP. No recovery of the impairment of the testes was observed past a certain degree of damage. The rats died after 1 yr of exposure, and malignant tumors were found in the kidneys.

81-2637. Brown, O. R.; Heitkamp, M.; Song, C. S. (John M. Dalton Res. Cent., Univ. Missouri, Columbia, MO 65211) **Niacin reduces paraquat toxicity in rats.** *Science* 212(4502): 1510-1512; 1981 (14 references).

Rats poisoned with paraquat benefited from daily niacin therapy. Niacin-treated rats showed delayed and reduced dyspnea. Deaths began ~ 30 hr later. The time required for niacin-treated rats to reach 50% mortality increased from 60 to 120 hr, and the death rate was reduced from 75 to 55%. The benefit by niacin is consistent with the demonstrated role of niacin in preventing cellular decreases of nicotinamide adenine dinucleotide during poisoning of bacteria by paraquat and by hyperbaric oxygen. (Author

abstract by permission. Copyright 1981 by the American Association for the Advancement of Science)

81-2638. Bishop, J. B.; Kodell, R. L. (NCTR, HFT-120, Jefferson, AK 72079) **The heritable translocation assay: its relationship to assessment of genetic risk for future generations.** *Teratog. Carcinog. Mutag.* 1: 305-332; 1981 (78 references).

The basic methodology of the heritable translocation assay (HTA) is described and brief background presented. Statistical considerations that affect the use of the HTA in both hazard evaluation and risk assessment are detailed. Developmental needs and perspectives for applying this assay to assessment of environmental mutagens are proposed. Pesticides evaluated by HTA are cadmium chloride, captan, dieldrin, ethylene oxide, TEPA, and thioTEPA. Three statistical parameters are essential to the design of toxicological tests, especially when such tests are to be used for regulatory purposes: the power of test desired, the relative increase in frequency of events, and the frequency of false-positive test errors or significance level. Each of these test parameters is discussed. A simplified but reasonable method of extrapolating HTA animal data to humans, similar to that used in extrapolating carcinogenesis data, is presented.

81-2639. King, S. (Author address not given) **Peropal—a new organotin miticide.** *Tin Its Uses* 128: 12-14; 1981.

A new miticide, Peropal, is discussed. The synthesis and structure of the compound, 1-tricyclohexylstannyl-1,2,4-triazole, is described. The compound is very persistent, because it resists the effects of rain and light. Toxicity assessments show this compound to be acceptable for commercial use. The oral LD50 for rats and mice were 671 and 2451 mg/kg, respectively. No mutagenic effects were seen resulting from doses of 2.5 mg/kg. Thirty mg/kg given to pregnant female rats did not prove to be embryotoxic or teratogenic.

81-2640. Carmines, E. L.; Carchman, R. A.; Borzelleca, J. F. (Div. Toxicol., Dep. Pharmacol., Med. Coll. Virginia, Virginia Commonwealth Univ., Richmond, VA 23298) **Investigations into the mechanism of paraquat toxicity utilizing a cell culture system.** *Toxic. Appl. Pharmacol.* 58(3): 353-362; 1981 (36 references).

Paraquat (PQ) and diquat (DQ) produced a dose-dependent inhibition of cellular proliferation in the $P388D_1$, macrophage-like cells in culture. DQ ($IC50 = 1.92 \times 10^{-5}$ *M*) was not significantly more potent than PQ ($IC50 = 1.05 \times 10^{-4}$ *M*). The dose-response lines did not deviate significantly from parallelism. Both herbicides had no effect on lipid peroxidation. Ferric pyrophosphate, a known stimulator of lipid peroxidation, produced a dose- and time-dependent stimulation. The effects produced by ferric pyrophosphate indicated that the absence of an effect due to PQ or DQ was not due to an insensitivity of the system. In addition, increasing the oxygen tension did not enhance the toxicity (as measured by cell growth) of PQ. There was no indication of PQ-induced membrane damage as indicated by the leakage of the cytoplasmic enzyme, lactate dehydrogenase. The effect of PQ and DQ on macromolecular synthesis was evaluated as a possible mechanism by which cell growth may have been inhibited. Both herbicides produced a dose- and time-dependent inhibition of DNA synthesis. DQ, but not PQ, inhibited RNA synthesis. Neither PQ nor DQ altered protein synthesis. The inhibition of DNA synthesis did not appear to be due to an alteration of the availability of the precursors. Mitochondrial function, as measured by oxygen consumption, was not affected, suggesting that the inhibition of DNA synthesis was not due to an alteration of energy metabolism. Cyclic nucleotide levels were also not affected, suggesting that the inhibition of cell growth and DNA synthesis was not due to an alteration of cellular control processes. These results suggest that inhibition of macromolecular synthesis may be involved in the molecular mechanism of toxicity of PQ. (Author abstract by permission)

81-2641. Rady, P.; Arany, I.; Uzvolgyi, E.; Bojan, F. (Dep. Hyg. & Epidemiol., Univ. Med. Sch., H-4012 Debrecen, Hungary) **Activity of pyruvate kinase and lactic acid dehydrogenase in mouse lung after transplacental exposure to carcinogenic and non-carcinogenic chemicals.** *Toxicol. Lett.* 8(4-5): 223-227; 1981 (17 references).

The effects of a variety of carcinogens, noncarcinogens, and non-carcinogenic pulmonary toxins on the activities of pyruvate kinase (PK) and lactate dehydrogenase (LDH) in mouse lung tissues following transplacental exposure were studied. On day 18 of pregnancy, the animals were dosed with the test compounds by injection. Offspring were killed 28 days after exposure. Two of the non-carcinogenic pulmonary toxins studied were the pesticides paraquat and cadmium chloride. These 2 compounds did not affect PK or LDH activities.

81-2642. Stammati, A. P.; Silano, V.; Zucco, F. (Lab. Tossicol., Ist. Super. Sanita, Rome, Italy) **Toxicology investigations with cell culture systems.** *Toxicology* 20(2-3): 91-153; 1981 (390 references).

Cell culture systems most frequently used in toxicology investigations are reviewed, with emphasis on their effectiveness in assessing the toxic potential of chemicals. Included in the discussion are metabolic studies and general and specific toxicology investigations. Cell culture techniques are important because toxicology investigations on animals are costly, time-consuming, and have other limitations. The various cell culture systems (primary culture, cell lines, or cell strains) are described, and some of the cell types used in toxicity investigations are listed. Some of the effects of pesticides on fibroblast and epithelial cells are tabulated. A description of cell-specific toxicology investigations includes several pesticides (carbaryl, lindane, propham, DDT, methyl parathion, paraquat, paraoxon) as examples. Metabolic investigations are also discussed.

81-2643. Stone, L. C.; Manson, J. M. (Dep. Environ. Health, Univ. Cincinnati, Cincinnati, OH 45267) **Effects of the herbicide 2,4-dichlorophenyl- *p*-nitrophenyl ether (nitrofen) on fetal lung development in rats.** *Toxicology* 20(2-3): 195-207; 1981 (24 references).

The effects of the herbicide nitrofen on lung development in rats were studied. Pregnant rats were administered 20, 31.2, and 50 mg/kg/day on days 8-18 of gestation. Fetal and newborn lungs were processed for biochemical analysis, surface tension measurements, or routine histology. These studies were conducted to determine if *in utero* exposure to nitrofen accelerated the catabolic metabolism of glucocorticoids by induction of mixed function oxidase enzymes, leading to a depression in glucocorticoid levels and delay in fetal lung surfactant synthesis. Analysis indicated fetal lung surfactant synthesis was not affected. Surface tension values of fetal lung extracts from nitrofen-treated females were not affected by treatment. Dexamethasone, with or without nitrofen, depressed corticosterone levels and minimum surface tension. It appears, therefore, that prenatal exposure to nitrofen has no effect on the parameters tested in this study.

81-2644. Costlow, R. D.; Manson, J. M. (Dep. Environ. Health, Med. Coll., Univ. Cincinnati, Cincinnati, OH 45267) **The heart and diaphragm: target organs in the neonatal death induced by nitrofen (2,4-dichlorophenyl-p-nitrophenyl ether).** *Toxicology* 20(2-3): 209-227; 1981 (28 references).

Studies were conducted to determine the effects on the heart and diaphragm of rats neonatally exposed to nitrofen. In one tests nitrofen was administered orally at rates of 75-250 mg/kg on day 11 of gestation, and in other tests, at 150 mg/kg on three consecutive days, between days 8-18 of gestation. Day 11 of gestation was the most sensitive with regard to induction of neonatal mortality. The LD50 for neonates was 116 mg/kg to the dam. Fetuses surviving the exposure on day 11 showed reduced weights, delayed ossification, and increased hydronephrosis and diaphragmatic hernias. Cardiac malformations in these animals included ventricular septal defects, double outlet right ventricle, and transposition of the great vessels. It is concluded from these studies that the heart and diaphragm are the target organs involved in neonatal death induced by nitrofen.

81-2645. Rao, T. N.; Subrahmanyam, D. (Dep. Biochem., Postgrad. Inst. Med. Educ. & Res., Chandigarh 160012, India) **Effect of DDT on adipose tissue lipolysis in rat.** *Toxicology* 20(2-3): 229-235; 1981 (15 references).

Studies were conducted to determine the effects of DDT on rat adipose tissue lipolysis. Acute feeding tests were conducted by feeding rats a single 600 mg/kg dose. Chronic tests were conducted by feeding rats 15 mg/kg/-day for 45 days. Distal portions of epididymal fat from treated animals were used for *in vitro* experiments on DDT exposure. DDT had no effect on the rate of glycerol release of isolated epididymal fat in noradrenaline- or caffeine-stimulated tissues or unstimulated tissues.

81-2646. Pilinskaya, M. A. (All-Union Res. Inst. Hyg. & Toxicol. Pestic. Polym. & Plast., Kiev, USSR) **Izuchenie tsitogeneticheskogo effekta ryada pestitsidov v kul'ture limfotsitov periphericheskoi krovi cheloveka pri razlichnom iskhodnom urovne aberratsii khromosom. [Cytogenetic effect of a number of pesticides in a culture of human peripheral blood lymphocytes with different levels of spontaneous chromosomal aberrations.]** *Tsitol. Genet.* 15(2): 82-84; 1981 (7 references) (Russian).

The potential mutagenic activity of the pesticides polymartsin, cuprotsin, and Pirimor (pirimicarb) was studied in a culture of peripheral blood lymphocytes from donors with different levels of spontaneous chromosomal aberrations. Incubation of lymphocyte culture with Pirimor increased the yield of chromosomal aberrations regardless of the level of spontaneous aberrations. Polymartsin and cuprotsin failed to induce chromosomal aberrations.

81-2647. Pedersen, A. G.; Pedersen, A.; Gregersen, M.; Kaempe, B. (Retsmedicinsk Inst., DK-8000 Arhus C., Denmark) **Paraquatforgiftning. [Paraquat poisoning.]** *Ugeskr. Laeg.* 143(19): 1202-1206; 1981 (30 references) (Danish).

Progressive respiratory insufficiency caused by severe pulmonary fibrosis, which was resistant to therapy, was the cause of death in a 57-yr-old woman who had been hospitalized as an emergency case 8 days previously with

acute renal insufficiency and hepatic involvement. Dyspnea, cyanosis, pyuria, a SGOT level of 108 U/l, and reduced serum albumin were found. Peritoneal dialysis and digoxin treatment were unsuccessful. It was established that the patient had drunk accidentally a preparation containing 24.7% paraquat and 31% diquat. A paraquat concentration of 3 μg/ml was found in a urine sample taken 15 days after ingestion of paraquat.

See also 81-2401, 81-2402, 81-2403, 81-2404, 81-2405, 81-2406, 81-2407, 81-2408, 81-2409, 81-2412, 81-2414, 81-2415, 81-2416, 81-2419, 81-2421, 81-2422, 81-2423, 81-2424, 81-2427, 81-2428, 81-2429, 81-2430, 81-2431, 81-2432, 81-2433, 81-2434, 81-2435, 81-2437, 81-2438, 81-2439, 81-2445, 81-2465, 81-2470, 81-2477, 81-2478, 81-2481, 81-2482, 81-2484, 81-2486, 81-2488, 81-2489, 81-2493, 81-2494, 81-2496, 81-2502, 81-2505, 81-2506, 81-2508, 81-2510, 81-2514, 81-2515, 81-2517, 81-2520, 81-2521, 81-2522, 81-2523, 81-2524, 81-2652 *and* 81-2655.

81-2648. Caprais, J. C.; Marchard, M. (Cent. Oceanol. Bretagne, CNEXO, F-29273 Brest, France) **Identification des organochlores a haut poids moleculaire par chromatographie en phase gazeuse sur colonnes capillaires. [Identification of high molecular weight organochlorine compounds by glass capillary gas chromatography.]** *Analusis* 9(4): 140-144; 1981 (5 references) (French).

The separation of several compounds, particularly PCB residues and some chlorinated insecticides such as dieldrin, DDT and metabolites, was greatly enhanced through the use of glass capillary columns in gas-liquid chromatography to identify high molecular wt organochlorine compounds. Chromatographic results obtained with the classical columns are compared with those obtained with glass capillary columns.

81-2649. Burns, D. A. (Technicon Ind. Syst., Tarrytown, NY) **The automated pesticide analytical laboratory.** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides.* Zweig, G. and Sherma, J., eds. (Academic Press: NY): 11(CH01): 43-53; 1980 (75 references).

Automation has been achieved in several instances involved in pesticide analysis through the logical combination of existing modules to perform unit operations. A careful study of the individual steps involved in any assay will indicate where the workload is large or growing, and where possibilities of automation exist. Frequently the cost of analyses can be minimized through the use of automation. Specific means of automating sampling techniques for solids, liquids and gases are discussed. Automation techniques for cleanup and pretreatment of individual samples are described, including information on extraction, chromatography, filtration and decantation, distillation, dialysis, concentration, and sweep codistillation. Automation during analysis and detection steps is discussed for direct analysis procedures such as colorimetry, raman spectroscopy, and chromatography (thin-layer and gas-liquid chromatography). Other detectors described include UV, electrochemical, flame photometric, and reaction detectors. Means of combining unit operations to achieve total automation are considered.

81-2650. Ivie, K. F. (Water Assoc., Milford, MA 02038) **High-performance liquid chromatography (HPLC) in pesticide residues analysis.** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides.* Zweig, G. and Sherma, J., eds. (Academic Press: NY): 11(CH02): 55-78; 1980 (23 references).

A major reason for the rapid advancement of high-performance liquid chromatographic (HPLC) techniques in the field of pesticide chemistry and residue analysis is the nondestructive nature of the technique. One major drawback to HPLC has been detector sensitivity for residue analysis. This limitation has to a large extent been overcome due to the methods of extraction and cleanup designed for liquid chromatography. With these techniques, analyses of samples in the ppt range are possible. Analysis of formulations has been simplified to the point of merely requiring the sample to be put into solution, filtered, and injected onto the LC column for separation and quantitation. Some cleanup may be required using techniques such as a SEP-PAK cartridge cleanup. For residue analysis, however, cleanup is still important. The most powerful technique currently under study is post-column derivatization. This technique may increase selectivity and sensitivity of a detector system.

81-2651. Sherma, J. (Chem. Dep., Lafayette Coll., Easton, PA 18042) **Quantitative thin-layer chromatography (TLC).** In: *Analytical Methods for Pesticides and Plant Growth Regulators, Updated General Techniques and Additional Pesticides.* Zweig, G. and Sherma, J., eds. (Academic Press: NY): 11(CH03): 79-122; 1980 (200 references).

This review of quantitative thin layer chromatography considers materials and methods for TLC-densitometry and specific applications of the method for particular pesticides and related chemicals. Sample preparation, the application of spots, precoated thin-layer plates, the mobile phase, the development of the chromatogram, detection of spots, and densitometry are discussed. Chromatographic systems that are specifically of use for chlorinated pesticides, organophosphorus pesticides, carbamate pesticides and related compounds, benomyl, thiabendazole, oxythioquinox (quinomethionate), dithiocarbamates, thiourea, triazines, captan, and captafol. A list of selected papers on the separation, detection, and analysis of pesticide standards, residues, and formulations is included.

81-2652. Karapally, J. C.; van Hoek, C.; Sauer, H. H. (Agro Div., Sandoz Ltd., CH4002 Basel, Switzerland) **Etrimfos.** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides.* Zweig, G. and Sherma, J., eds. (Academic Press: NY): 11(CH04): 125-138; 1980 (6 references).

Etrimfos is the active ingredient of the insecticide Ekamet. Its action is exerted by direct contact and as a stomach poison. In one of the 2 recommended analytical methods, etrimfos is separated from by-products by paper chromatography. Phosphorus content is determined by combustion of the etrimfos spot on the chromatogram, followed by colorimetric determination. The second method involves gas chromatographic techniques coupled with a flame ionization detector. The major metabolic pathway involves the cleavage of the ArO−P bond, leading

to the formation of 6-ethoxy-4-hydroxypyrimidine. The recommended method for residue analysis requires extraction of the crop or soil with acetone and partial cleanup by partitioning between water and methylene chloride. Further cleanup is accomplished by a polyethylene-coated alumina chromatography column. Samples are analyzed by gas chromatography with a flame ionization detector.

81-2653. Gunew, D. S. (Cent. Res. Lab., ICI Australia Ltd., Ascot Vale, Victoria 3032, Australia) **Promacyl.** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides.* Zwieg, G. and Sherma, J., eds. (Academic Press: NY): 11(CH05): 139-146; 1980 (6 references).

Technical formulations of the acaricide promacyl and Promicide (AI promacyl) emulsifiable concentrate are analyzed for purity by gas chromatography. Use is made of the ratio of peak area of 3-isopropyl-5-methylphenyl *N*-butyl-*N*-methylcarbamate to that of an internal standard. Technical promacyl and Promicide emulsifiable concentrate are also analyzed for residual unreacted 3-isopropyl-5-methylphenyl *N*-methylcarbamate by HPLC on a silica column with *n*-hexane-isopropanol as eluent. A method which allows for the determination of promacyl and 2 metabolites in the tissues and milk of cattle is mentioned. Tungstophosphoric acid, salting out, and pH adjustment are used to release promacyl and promecarb for extraction from cattle dip samples. Extracts are analyzed for promacyl by gas chromatography and for promecarb by HPLC.

81-2654. Wisson, M.; van Hoek, C.; Sauer, H. H. (Agro Div., Sandoz Ltd., CH4002 Basel, Switzerland) **Quinalphos.** In: *Analytical Methods for Pesticides and Plant Growth Regulators, Updated General Techniques and Additional Pesticides,* Zweig, G. and Sherma, J., eds. (Academic Press: NY): 11(CH06): 147-163; 1980 (8 references).

Quinalphos is a cholinesterase inhibitor whose antidotes are atropine with P2AM and obidoxime chloride. Commercial preparations are effective against a wide range of chewing, sucking, biting, and leaf-mining pests, particularly in the orders Lepidoptera, Homoptera, Coleoptera, Diptera, and Thysanoptera. Quinalphos in technical products and formulations can be determined by phosphorus combustion, thin-layer chromatography in combination with assay by UV spectrometry and gas-liquid chromatography. Investigations have determined that the active ingredient is rapidly degraded on and in treated media. The predominant degradation pathway is by chemical and/or enzymatic hydrolysis, yielding 2-hydroxyquinoxaline. Gas chromatography with alkaline flame ionization detection or flame photometric detection is the method of choice for determining quinalphos residues due to the high selectivity, sensitivity, and precision of the method. For confirmation, a TLC method using visualization with a highly selective spray reagent is recommended.

81-2655. Orloski, E. J. (Am. Cyanamid Co., Agric. Res. Div., Princeton, NJ 08540) **Terbufos (COUNTER soil insecticide).** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides.* Zweig, G. and Sherma, J., eds. (Academic Press: NY): 11(CH07): 165-183; 1980 (3 references).

COUNTER (terbufos) is a soil insecticide applied as a granular formulation to the soil at planting time or following crop emergence and is lightly incorporated into the soil for control of a variety of insects. It is used in the cultivation of corn crops. Formulation analysis is conducted by diluting methyl alcohol extracts of granules to an appropriate volume with methyl alcohol, and the insecticide content is determined by a gas-liquid chromatographic procedure that uses an internal standardization technique. Metabolism of terbufos in corn and sugar beets produces several toxic metabolites: sulfoxide, sulfone, oxygen analog, oxygen analog sulfoxide, and oxygen analog sulfone. The hydrolytic metabolites contain no phosphorus and are not significantly toxic. The residue method of analysis is based on the oxidation of terbufos and its oxidative metabolites with metachloroperbenzoic acid to the oxygen sulfone, which is determined by GLC using an alkali flame ionization detector. Several cleanup procedures are used including wet benzene and charcoal, and the precipitating technique with ammonium chloride and phosphoric acid.

81-2656. Wisson, M.; van Hoek, C.; Sauer, H. H. (Agro Div., Sandoz Ltd., CH4002 Basel, Switzerland.) **Thiocyalam-hydrogenoxalate.** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides.* Zweig, G. and Sherma, J., eds. (Academic Press: NY): 11(CH08): 185-194; 1980 (7 references).

Thiocyclam-hydrogenoxalate (Evisect) is a contact and stomach insecticide active against larvae and adults of several chewing pests, such as Lepidoptera and Cleoptera. Thin layer chromatography and high-performance liquid chromatography (HPLC) can be used to analyze thiocyclam-hydrogenoxalate in technical products and formulations. In TLC, the active ingredient is dissolved in a mixture of toluene-methanol- triethylamine, the liberated thiocyclam is then separated from by-products and impurities by TLC, eluted from the silica gel layer, and quantitated by UV spectrometry at 266 nm. In HPLC, thiocyclam-hydrogenoxalate is separated on a reversed-phase column and assayed by UV detection using an internal-standard method. Residue analysis is based on extraction of the active ingredient and its metabolite from

crop material and soil with methanol-containing hydrochloric acid. Cleanup is done by liquid-liquid partitioning between acidic aqueous solution and methylene chloride, as well as alkaline aqueous solution and methylene chloride. Determination is done by gas chromatography using a flame photometric detector with a sulfur filter or an electron capture detector.

81-2657. Newsome, W. H. (Food Res. Div., Food Dir., Dep. Natl. Health & Welfare, Ottawa, Ontario, Canada) **Ethylenebisdithiocarbamates and their degradation products.** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides,* Zweig, G. and Sherma, J., eds. (Academic Press: NY): 11(CH09): 197-226; 1980 (64 references).

The ethylenebisdithiocarbamates (EBDC) are inherently unstable and degrade into a number of products such as ethylenethiourea, ethyleneurea, 2-imidazole, ethylenethiuram monosulfide, and ethylenebisisothiocyanate. The chemical and physical properties of these degradation products and their toxicities are listed. Due to their insolubility, EBDCs are not taken up and metabolized by plants. However, EBDCs are subjected to photochemical and oxidative degradation, and the degradation products are absorbed. For residue analysis, EBDCs are reduced and hydrolyzed to ethylenediamine which is isolated by ion exchange chromatography, trifluoroacetylated, and determined as the trifluoroacetate by gas-liquid chromatography (GLC) with electron capture detection (ECD). Thin-layer chromatography and GLC for ethylenethiourea are reviewed. For ethyleneurea, extraction is performed with acetone and the extract alkylated to remove ethylenethiourea. After partial cleanup, ethyleneurea is derivatized with pentafluorobenzoyl chloride and the derivative purified on silicic acid chromatography. Pentafluorobenzoyl ethyleneurea is quantitated by liquid chromatography with UV detection and confirmed by GLC with electron capture detection. The use of a cation exchange column for 2-imidazoline detection is discussed and a polarographic method for ethylenethiuram monosulfide described. Extraction for ethylenebisisothiocyanate is carried out with ethanol and partitioning into toluene. The isothiocyanate is quantitated by GLC with ECD.

81-2658. van Rossum, A.; de Boer, F. G.; Cannizzaro, R. D.; van Moorselaar, R.; Stewart, T. E.; de Wilde, P. C. (Philips-Duphar B. W., Weesp, Holland.) **Fentin hydroxide.** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides.* Zweig, G. and Sherma, J., eds. (Academic Press: NY): 11(CH10): 227-246; 1980 (6 references).

Chemical, physical, and biological properties of fentin hydroxide are described briefly and analytical methods are presented. Fentin hydroxide is a nonsystemic fungicide effective against many fungi susceptible to copper fungicides. Fentin hydroxide can be determined by titration with HCl. For aged products, a gas-chromatographic procedure gives better results. In this procedure the fentin is converted into butyltriphenyltin with butylmagnesium chloride. In mixed formulations containing dithiocarbamates, fentin compounds are converted with *n*-butylmagnesium chloride into butyltriphenyltin, which is extracted with toluene and chromatographed on a column composed of 5% SE 30 on Chromosorb WpHP. *n*-Docosane is used as an internal standard. Two types of residue analysis are available: wet ashing of the fentin hydroxide followed by determination of the inorganic tin by polarography, an Argon inductive coupled plasma system, or colorimetry; and derivatization of the fentin hydroxide followed by a gas chromatographic determination of the derivative. The most accepted method involves extraction, cleanup, wet destruction of fentin hydroxide, and colorimetric determination of Sn^{++} with dithizone, phenylfluorone, or pyrocatechol violet.

81-2659. Lacroix, L.; Laurent, M.; Buys, M. (Rhone-Poulenc, Res. & Devel., Centre Nicolas Grillet, F 94400, Vitre-sur-Seine, France) **Iprodione.** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides.* Zweig, G. and Sherma, J., eds. (Academic Press: NY): 11(CH11): 247-261; 1980 (8 references).

Physical, chemical, and biological properties and methods of analysis of iprodione are reviewed. Iprodione is a contact fungicide that acts on spore and mycelium; it is effective against a number of parasitic fungi. UV or infrared spectrometric methods, as well as total chlorine or nitrogen determinations, may be used for the analysis of technical products and formulations, but may be sensitive to interference from formulation additives or impurities. Chromatographic methods are preferred. HPLC, by the internal standard procedure, is the recommended method. Elution is done with a four solvent system of constant composition throughout the analysis. Detection is by UV absorption. Gas-liquid chromatography (GLC), by the internal standard method, is performed on a nonpolar silicone stationary phase with a thermal conductivity detector. Several methods are available for determining iprodione residues; these methods involve similar extraction and cleanup procedures, but differ in the determination of residues in the purified crop extract. The routinely used method involves electron-capture GLC. A biological method is also available.

81-2660. Day, E. W., Jr.; Koons, J. R.; Decker, O. D. (Lilly Res. Lab., Greenfield Lab., Greenfield, IN 46140) **Tricyclazole.** In: *Analytical Methods for Pesticides and*

Plant Growth Regulators. Updated General Techniques and Additional Pesticides. Zwieg, G. and Sherma, J., eds. (Academic Press: NY): 11(CH12): 263-273; 1980 (5 references).

Physical, chemical, and biological properties of tricyclazole are described briefly, and analytical methods for tricyclazole are reviewed. Tricyclazole is a systemic fungicide for the control of rice blast disease, *Piricularia oryzae.* It is rapidly absorbed by the rice leaves and roots and translocated toward the leaf tip. Gas chromatography (GC) and high-performance liquid chromatography (HPLC) have been successfully used for the determination of tricyclazole in technical material and the wettable powder formulation. For GC, the tricyclazole is dissolved in or extracted with chloroform and then assayed by GC using flame ionization detection. For HPLC, the tricyclazole is dissolved in or extracted with an appropriate solvent and measured by variable wavelength UV detector at 225 nm. The principal metabolic pathway in plants involves oxidation of the methyl group. Both the parent, tricyclazole, and the alcohol metabolite are determined in residue analysis by GC utilizing a flame photometric detector operating in the sulfur mode. Residues are extracted from rice tissues by refluxing samples in 4 *N* sulfuric acid, and from soil by refluxing in methanol-water. Neutralization and liquid-liquid extraction followed by alumina column purification provide interference-free extracts.

81-2661. Wiedmann, J. L.; Mitten, M. E.; Bolgrin, D.; Pensyl, J. (PPG Ind. Inc., Chem. Div., Barberton, OH 44203) **Chlorpropham.** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides.* Zwieg, G. and Sherma, J., eds. (Academic Press: NY): 11(CH13): 277-289; 1980 (8 references).

Physical, chemical, and biological properties of chlorpropham (CIPC) are described, and methods of analysis for CIPC are reviewed. Chlorpropham acts as a highly selective pre- and postemergence herbicide, affecting chiefly annual weeds. Herbicide formulations include a 4 lb/gal emulsifiable concentrate and 10 and 20% granular formulations on Attapulgite clay. Growth regulator formulations include a 4 lb/gal aerosol grade and a special 3 lb/gal emulsifiable concentrate. Formulation analysis is by infrared measurement of the 1736 cm^{-1} carbonyl band of CIPC. Microbial degradation products of chlorpropham in soil are carbon dioxide and soil-bound residues. No identifiable soil metabolites are known. An extraction procedure must be used to analyze chlorpropham in soil, because any procedure that degrades chlorpropham to m-chloroaniline will also degrade some of the soil-bound residue, giving false readings. For residue analysis, chlorpropham is readily dissolved in methanol and methylene chloride. Either of these may be used to remove chlopropham from crop tissues. Determination is by HPLC with a CN column and UV detector.

81-2662. Steller, W. A. (Am. Cyanamid Co., Agric. Res. Div., Princeton, NJ 08540) **Difenzoquat (AVENGE wild oat herbicide).** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides,* Zwieg, G. and Sherma, J., eds. (Academic Press: NY): 11(CH14): 291-305; 1980 (3 references).

Methods of analysis for difenzoquat, the active ingredient in AVENGE and FINAVEN, are presented, and its physical, chemical, and biological properties are discussed briefly. Difenzoquat is a selective herbicide for the postemergence control of wild oats in barley and fall-seeded wheat varieties grown throughout the world. For formulation analyses, the 1,2-dimethyl-3,5- diphenyl pyrazolium ion is measured using the chromophore generated in dimethylformamide by reaction with a quaternary hydroxide. Difenzoquat is essentially inert metabolically. It is not degraded by soil microorganisms. However, photodegradation studies have shown that difenzoquat is readily demethylated photolytically yielding the relatively volatile uncharged monomethyl pyrazole of difenzoquat. Residues of difenzoquat can be determinated by gas-liquid chromatography; in the heater injection port, difenzoquat is also demethylated and converted to the uncharged monomethyl pyrazole.

81-2663. Fabbrini, R.; Galluzzi, G. (Montedison S.P.A., Agric. Div., Pestic. Res. Cent., Milan, italy) **Drepamon.** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides.* Zwieg, G. and Sherma, J., eds. (Academic Press: NY): 11(CH15): 307-318; 1980 (2 references).

The physical, chemical, and biological properties of the pre- and postemergence herbicide Drepamon (tiocarbazil) are discussed briefly. Two methods of formulation analysis are presented: gas-liquid chromatography using a flame ionization detector and thin-layer chromatography followed by estimation of nitrogen. The precision of the methods is calculated to be ± 1.2% and ± 1% for GLC and TLC, respectively. For residue analysis Drepamon and its metabolite, *N,N*-di-sec-butylcarbamoylthiolglycolic acid, are extracted from plant tissue and soil with an acid methanol solvent. The extract is purified by liquid-liquid partitioning and column chromatography. Recoveries at 0.05-0.1 ppm levels were 80-100% for both Drepamon and its metabolite.

81-2664. Amadori, E.; Heupt, W. (Celamerck, D-6507 Ingelheim, BRD) **Flurecol.** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides.* Zwieg, G. and Sherma, J., eds. (Academic Press: NY): 11(CH16): 319-329; 1980 (5 references).

The biological, physical, and chemical properties, history of use, and formulations of the herbicide flurecol (flurenol) are discussed briefly. Flurecol and its derivatives act via leaves and root growth-retarding and suppressing agents in dicotyledonous plants. The methods for analysis of technical flurecol must be specific with respect to acidic by-products. Alkalimetric titration cannot be used alone due to the presence of other carboxylic acids. A suitable method consists in the combination of alkalimetric titration and GLC. The recommended method is based on measuring UV absorbance at 273 nm. Residues of flurecol and flurecol-butyl have been determined colorimetrically or by GC. In both cases the parent compound has to be transformed completely to fluorenone. For colorimetric determination, the fluorenone is converted to the *p*-nitrophenylhydrazone and extinction is measured at 597 nm. For GC the sensitive determination of fluorenone by electron capture detection is carried out.

81-2665. Adler, I. L.; Hofmann, C. K. (Agric. Prod. Res., Rohm & Haas Co., Spring House, PA 19477) **Oxyfluorfen.** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides.* Zwieg, G. and Sherma, J., eds. (Academic Press: NY): 11(CH17): 331-341; 1980 (3 references).

The biological, physical, and chemical properties, history of use, and formulations of oxyfluorfen are discussed briefly. The analytical method for measuring the active ingredient in oxyfluorfen is presented. Gas chromatography of an aliquot of the sample in dioxane is carried out using triphenylmethane as an internal standard. For residue analysis the sample is first extracted with an appropriate solvent in a Waring Blender. The extract is filtered with vacuum and partially cleaned up by liquid-liquid partitioning. The sample is purified further by column chromatography and quantitated by Ni EC-GLC. A terminal residue method that uses gas-liquid chromatography (GLC) for measuring residues of the active ingredient in oxyfluorfen and its corresponding metabolites is also presented. The parent compound and its reduced residues are converted chemically to the corresponding amine, further converted to the heptafluorobutyramide derivative, and quantitated by electron capture GLC.

81-2666. Lynch, V. P.; Rowe, R. R. (Murphy Chem. Ltd., Wheathampstead, St. Albans, Hertfordshire AL4 8QU, England) **Quintex.** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides.* Zwieg, G. and Sherma, J., eds. (Academic Press: NY): 11(CH18): 343-350; 1980.

Composition, biological properties, and formulation of Quintex are discussed, and methods of analysis are presented. Quintex is an emulsifiable concentrate containing 3, 13, and 3% of fenuron, propham, and chlorpropham, respectively. These ingredients are determined by a high-performance liquid chromatographic procedure with a UV detector. For residue analysis the sample is extracted with methanol. After cleanup by solvent extraction, fenuron, propham, and chloropropham are converted to their tribromoacetanilide derivatives by heating under reflux in glacial acetic acid containing bromine. The resultant derivatives are determined on a gas-liquid chromatograph fitted with an electron capture detector.

81-2667. Loh, A.; Frank, R.; Decker, O. D. (Lilly Res. Lab., Greenfield Lab., Greenfield, IN 46140) **Tebuthiuron.** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides.* Zwieg, G. and Sherma, J., eds. (Academic Press: NY): 11(CH19): 351-361; 1980 (2 references).

Tebuthiuron is a broad spectrum herbicide for control of herbaceous and woody plants. Its biological, physical, and chemical properties are discussed briefly. Tebuthiuron can be analyzed by gas chromatography following derivatization with trifluroacetic anhydride and by HPLC using a μ Bondapak CN column. Technical tebuthiuron and the 80WP formulation can be analyzed spectrometrically by measuring absorbance at 252 nm after an aqueous hydrochloric acid purification. For residue analysis tebuthiuron is extracted from soil either with water-methanol or sequentially with water-methanol and hot hydrochloric acid. Aliquots from the extract are combined and partitioned with dichloromethane. The extract is further purified by alumina column chromatography and measured by GC using flame photometric detection.

81-2668. Wolf, M. H.; Yu, W. C.; Fine, D. H. (Anal. Serv. Lab., Thermo Electron Corp., Waltham, MA 02154) **Analysis of *N*-nitroso compounds in pesticide formulations.** In: *Analytical Methods for Pesticides and Plant Growth Regulators. Updated General Techniques and Additional Pesticides.* Zwieg, G. and Sherma, J., eds. (Academic Press: NY): 11(CH20): 363-387; 1980 (131 references).

Analytical method useful in the determination of nitrosoamine contamination of pesticide formulations at sub-ppm levels are described. Most commonly, TEA analyzer and/or various mass spectrometric techniques are used. However, other analytical techniques can be used, depending on sample complexity. Thin-layer chromatographic methods are used because of their simplicity and low cost. Other techniques that are available include polarography, electrochemical detection, colorimetry, spectrophotometry, gas chromatography with nitrogen-specific detectors, and derivatization (trimethylsilyl, nitramines, heptafluorobutyryl adducts, hydrazines, and amines). Analyses for the following

specific chemicals or chemical classes are described: products formulated as amine salts, dinitroaniline herbicides, carbamates, ureas, organophosphates, and heterocyclic nitrogen compounds.

81-2669. Pavoni, G. (Lab. Chim. Prov. Bologna, I-40138 Bologna, Italy) **Uso della spettrofotometria derivata UV per al determinazione di benomyl, MBC, TBZ in frutta e ortaggi. [Use of UV spectrophotometry for determination of benomyl, MBC (carbendazim) and TBZ (thiabendazole) in fruit and vegetables.]** *Boll. Lab. Chim. Prov.* 5(4): 601-610; 1979 (13 references) (Italian).

A modified UV spectrophotometric method of the qualitative and quantitative determination of benzimidazole derivatives, such as benomyl, TBZ (thiabendazole) and MBC (sodium chlorate) separately or in mixtures in fruits and vegetables is described. After extraction with ethyl acetate, the extract is cleaned up by successive passages in acidic aqueous phase before spectrophotometric analysis at 230-350 nm; 0.1*N* hydrochloric acid saturated with ethyl acetate is used as a blank sample.

81-2670. Collins, D. M.; Fawcett, J. P.; Rammell, C. G. (Anim. Health Ref. Lab., Minis. Agric. & Fish., Wellington, New Zealand) **Determination of sodium fluoroacetate (Compound 1080) in poison baits by HPLC.** *Bull. Environ. Contam. Toxicol.* 26(5): 669-673; 1981 (12 references).

A technique for the determination of sodium fluoroacetate (Compound 1080) in poison baits for vertebrate pests is described. A 20-gram sample is homogenized in 200 ml of water, then brought to volume (100 ml) and left overnight. A 1.0-ml sample is mixed with 100 µl 5 *M* orthophosphoric acid and distilled; pH adjusted and then sample is derivatized. The samples are chromatographed on a 25-cm RP-8 reverse phase column. A high pressure liquid chromatography system is used, comprising of a Tracor 995 pump, a Rheodyne 7120 injector with 100-µl loop, and a Varian Fluorichrom fluorescence detector. Recoveries of 83 and 99% were obtained for duplicate samples of bait spiked with 100 and 1000 mg of the pesticide.

81-2671. Kieboom, A. J.; Rammell, C. G. (Anim. Health Ref. Lab., Min. Agric. & Fish., Wellington, New Zealand) **Determination of brodifacoum in animal tissues by HPLC.** *Bull. Environ. Contam. Toxicol.* 26(5): 674-678; 1981 (5 references).

A high-pressure liquid chromatography (HPLC) method for the determination of brodifacoum in animal tissues and fluid is presented. Brodifacoum is an anticoagulant with a high toxicity for the rat, and is being considered for vertebrate pest control in New Zealand. The samples tested were obtained from necropsied animals which had been dosed orally with sublethal and lethal doses of brodifacoum. Minced tissues were extracted with dichloromethane/cyclohexane prior to HPLC analysis. The response to 100 µl injection of brodifacoum standards was linear up to 4 µg of brodifacum for absorbance and up to 5 µg for fluorescence. Detection limits were 0.05 mg/kg. Other anticoagulants in use (warfarin, racumin, difenacoum) can be readily differentiated from brodifacoum by their relative retention times and absorbance-fluorescence response ratios.

81-2672. Adachi, K. (Public Health Inst. Hyogo Prefecture, 2-1 Arata-cho Hyogu-ku, Kobe 652, Japan) **Mass fragmentographic determination of polymethylbiphenyl in foods contaminated with petroleum products.** *Bull. Environ. Contam. Toxicol.* 26(6): 737-744; 1981 (5 references).

A mass fragmentographic method for the determination of polymethylnaphthalene (PMN) and polymethylphenanthrene (PMP) to confirm petroleum contamination of foods is described. Polymethylbiphenyl (PMPB) was also analyzed. Ten different food products were analyzed and compared with samples of crude oil and kerosene. Extraction with ethanol and Florisil column cleanup preceded activated charcoal column chromatography and mass fragmentography. Mass fragmentograms are presented along with residue data which indicate that a wide variety of foods are contaminated with petroleum oil. It is concluded that the major sources of oil contamination in food include general environmental pollution, oil spills, and the wide use of petroleum emulsions as pesticide formulations in agriculture.

81-2673. Bezuidenhout, F. J.; van Dyk, L. P. (Plant Prot. Res. Inst., Dep. Agric. & Fish., Pretoria, South Africa) **A comparison of chromatographic and spectrophotometric methods for the determination of carbaryl residues in cabbages.** *Bull. Environ. Contam. Toxicol.* 26(6): 789-794; 1981 (9 references).

A variety of chromatographic and spectrophotometric techniques were utilized for the analysis of cabbage samples for the pesticide carbaryl. Gas chromatography was conducted with different extraction solvents and procedures. High-performance liquid chromatography (HPLC) and thin layer chromatography were conducted using several different published methods; solvents, cleanup, and extraction procedures varied. The results of comparison of the method are presented in tabular form. Extraction time, analysis time/sample, limit of detection, accuracy, and precision of each technique were presented. The shortest extraction time was for a thin layer chromatographic techniques (30 min). The shortest analysis time was for gas chromatography and HPLC (20

min). The lowest limit of detection was seen in one of the GC methods (0.004 mg/kg). Thin layer chromatography was the most accurate (100%). GC and the spectrophotometric procedures were the most precise (± 2-3%). A cost comparison illustrates that instrumentation, reagents, and analysis with spectrophotometric methods are much less expensive than the other techniques. This method is concluded to be the most suitable for the analysis of carbaryl in cabbage samples.

81-2674. Addison, J. B. (Div. Sci., Governors State Univ., South Forest Park, IL 60466) **Measurement of vapor pressures of fenitrothion and matacil.** *Chemosphere* 10(4): 355-364; 1981 (11 references).

A gas saturation technique was used to measure the vapor pressures of Matacil (aminocarb) and fenitrothion. Polyurethane foam was used to trap volatilized pesticide from sand and glass surfaces. Porapak Q was used to trap volatilized pesticides from Balsam Fir foliage. Equations were formulated that describe the linear relation of the vapor pressures of Matacil and fenitrothion to the reciprocal temperature of quartz sand samples containing the pesticides. The greatest vapor loss rates occurred from sand treated with fenitrothion, followed by vapor loss rates from glass, and lastly from leaf surfaces.

81-2675. Sattar, M. A. (Dep. Chem., Univ. Jyvaskyla, SF-40100 Jyvaskyla 10, Finland) **Efficiency of pentafluorobenzyl derivative for the simultaneous determination of MCPA and its metabolites in soil.** *Chemosphere* 10(4): 423-430; 1981 (38 references).

The recovery yield efficiency of MCPA (1) and 2 of its soil derivatives, 4 chloro-*o*-cresol (2) and 5-chloro-3-methylcatechol (3) following derivatization with pentafluorobenzyl bromide (PFB) solution was studied. These PFB derivatives were mixed with soil extracts and stored at 6°C for 100 wk; these samples were analyzed and compared with fresh samples. Results showed that PFB does affect yields of stored solutions. Both fresh and stored solutions of PFB can be used to determine MCPA and its metabolites from fresh and stored solutions. For separate determination of compounds 2 and 3, fresh samples treated with fresh PFB are recommended.

81-2676. Soulas, G.; Fournier, J. C. (Inst. Natl., Rech. Argon., Lab. Microbiol. Sols, France) **Soil aggregate as a natural sampling unit for studying behaviour of microorganisms in the soil: application to pesticide degrading microorganisms.** *Chemosphere* 10(4): 431-440; 1981 (13 references).

Prolonged storage of soil aggregates under dry conditions significantly reduced the development of metabolizing soil microflora that were capable of degrading 2,4-D. However, wetting of soil a few days before 2,4-D treatment partially restored 2,4-D metabolizing microflora. Co-metabolizing microbes were found in every soil aggregate tested after an 8-day storage period. The degradation kinetics of 2,4-D in soil aggregates were calculated by measuring the evolution of labeled CO_2 plus the residual radioactivity from soil samples spiked with labeled 2,4-D. Results of these experiments confirmed the results of the storage tests. These findings raise questions concerning the validity of experiments using stored soil when studying a process controlled by microbial action.

81-2677. Houk, E. J.; Hardy, J. L.; Cruz, W. J. (Nav. Biosci. Lab., Sch. Public Health, Univ. California, Oakland, CA 94625) **Acetylcholinesterases of the mosquito, *Culex tarsalis* coquillett.** *Comp. Biochem. Physiol. C* 69(1): 117-120; 1981 (26 references).

The effects of Triton X-100 solubilization on the number and distribution of isozymes detectable by isoelectric focusing electrophoresis were examined in this study of AChE activity in the mosquito. Several histochemical methods were evaluated for their efficiency and specificity in the detection of AChE activity in acrylamide gels. Two isozymes were identified. One was predominantly ganglionic and had an isoelectric point of 5.5. The other was extranganglionic and had an isoelectric point of 4.6. An acetylthiocholine hydrolysis method was modified by elevation of the pH to 7.2 and substitution of Hanker-Yates reagent for ammonium sulfide. These modifications greatly enhanced the sensitivity of the detection of this mosquito's acetylcholinesterases.

81-2678. Borszeki, B.; Katalin, S. (Hungarian Bur. Stand., H-1091 Budapest, Hungary) **Az elelmiszerekben elofordulo novenyvedo szer maradekok vizsgalatanak szabvanyositasa. [Standardization of the analysis of pesticide residues in food.]** *Elelmez. Ipar* 35(4): 140-141; 1981 (Hungarian).

In 1978, the preparation of a series for the standards testing of pesticide residues in foods was started by the Hungarian Bureau of Standards. Eighteen standards were prepared by a group of experts on the basis of a priority list established in 1979-1980. These standards provide definitions, sampling procedures, sample preparation, and standardized analytical methods for the pesticides most hazardous to human health due to their toxicity, persistence, and extent of use (organochlorine pesticides, organophosphate esters, carbamates, and dithiocarbamates). The standard methods establish limit values with adequate sensitivity.

81-2679. Waliszewski, S. (Inst. Pflanzen chutz, Poznan, Poland) **Bestimmung von Rueckstaenden von**

Triazophos (Hostathion) in Rapssamen. [Determination of triazophos (Hostathion) in rape seeds.] *Fresenius Z. Anal. Chem.* 306(5): 401-402; 1981 (German).

A method for the determination of triazophos (Hostathion) residues in rape seeds is described. After extraction from the homogenized seeds with acetonitrile, partition in hexane, and cleanup on alumina, the substance is determined by gas chromatography with AFID detector. The recovery rate is 89.3 ± 5.0% at 0.088 ppm. The detection limit is 0.01 ppm.

81-2680. Kiseleva, N. I.; Klisenko, M. A.; Gned, S. I. (All-Union Res. Inst. Hyg. & Toxicol. Pestic. Polym. & Plast., Kiev, USSR) **Metody identifikatsii i opredeleniya *N′,N′*-dimetil- *N*-(3-khlorfenil) -guanidina v vode. [Methods of identification and determination of *N′,N′*-dimethyl- N-3-chlorophenyl) -guanidine in water.]** *Gig. Sanit.* 46(4): 49-50; 1981 (2 references) (Russian).

A highly sensitive, selective, and relatively simple method of identification and determination of the fungicide *N′,N′*-dimethyl- *N*-(3-chlorophenyl) -guanidine (PDN) in cucumbers and water is described. The method is based on fungicide extraction with organic solvent in the alkaline medium, purification of the extract by thin layer chromatography, and identification of PDN in a thin layer of aluminum oxide. The method is specific in the presence of urea derivatives and certain carbamates. The sensitivity of the method is 0.02 mg/l (water) and 0.2 mg/kg (cucumbers).

81-2681. Kislushko, P. M.; Skur'iat, A. F. (Byrlorussian Res. Inst. Plant Prot., Minsk, USSR) **Kromatograficheskow opredelenie propizimida (Kerba) v vode, pochve i rasteniyakh. [Chromatographic determination of propizamide (Kerb) in water, soil and plants.]** *Gig. Sanit.* 46(5): 37-38; 1981 (6 references) (Russian).

Chromatographic determination of the herbicide Kerb (propyzamide; pronamide) in soil, water and plants is described. The method is based on herbicide extraction with chloroform (water and plants) or with acetone (soil), purification by column chromatography, and analysis by thin-layer or gas-liquid chromatography. Sensitivity of thin-layer chromatographic determination was 0.1 mg/kg for plants and soil and 0.02 mg/l for water. Sensitivity of gas-liquid chromatographic determination was 0.02 mg/l for water and 0.03-0.05 mg/kg for soil and plants.

81-2682. Castegnaro, R.; Walker, E. A. (Unit Environ. Carcinog., Int. Agency Res. Cancer, Lyon, France) **Report on collaborative studies of the determination of volatile nitrosamines in cheese and pesticides.** *IARC Sci. Publ.* 31: 445-453; 1980 (3 references).

Vials containing 10 ml of the dimethylamine salt of MCPA were distributed to 19 laboratories. Samples contained *N*-nitrosodimethylamine (NDMA) as a contaminant and 0.975 mg/l *N*-nitrosodipropylamine (NDPA) as an internal reference. The results are presented in tabular form. Gas chromatography (GC) or high-performance liquid chromatography coupled with thermal energy analyzer (TEA) were the methods used in most cases. Direct sample injection was attempted by 4 laboratories; one of these reported NDMA residues 2-3 fold higher than those obtained using an extraction technique. Sample preparation methods used included dilution, distillation followed by direct extraction, distillation from mineral oil, column absorption and subsequent elution, and clean-up by column chromatography or liquid-liquid partition systems. With one exception, recoveries were 75-100%. No correlation between NDMA levels and storage time was found. Statistical evaluation of the results for the 3 groups of extraction techniques was also carried out. Methods using direct extraction with dichloromethane and GC/TEA were concluded to be unsuitable. Methods using distillation from mineral oil and GC/TEA were more accurate. Methods using adsorption of the sample on a column and GC/TEA were concluded to be most suitable.

81-2683. Zweig, G.; Selim, S.; Hummel, R.; Mittelman, A.; Wright, D. P., Jr.; Law, C., Jr.; Regelman, E. (US EPA, Washington, DC) **Analytical survey of *N*-nitroso contaminants in pesticide products.** *IARC Sci. Publ.* 31: 555-564; 1980 (7 references).

Various pesticide products were analyzed using a variety of methods to determine nitrosamine contamination. The thermal energy analyzer, suitable for all types of nitrosamines, was usually combined with either a gas-liquid chromatograph or a liquid chromatograph. The direct-injection method has been criticized as unreliable. UV absorption combined with high-performance liquid chromatography has been used as both primary and secondary means of detection with a sensitivity of < 3 mg/kg. Levels of *N*-nitroso dialkylamines in dinitroaniline derivatives have decreased considerably in current production due to process changes. Butralin and pendimethalin contain significant amounts of *N*-nitroso compounds. Low or non-detectable levels of NDMA were found in most dimethylamine salts of phenoxyalkanoic acids. Quaternary ammonium compounds contained NDMA up to 16.8 mg/kg. Two morpholine derivatives appeared to contain *N*-nitrosomorpholine. The triethanolamine salt of dinoseb contained over 200 mg/kg *N*-nitrosodiethanolamine. Many amides, carbamates, organophosphates, triazines, urea derivatives and other nitrogen-containing pesticides did not contain *N*-nitrosamines above 1 mg/kg. Most *N*-nitroso contamination can be avoided by simple process changes.

81-2684. Mann, J. B.; Freal, J. J.; Enos, H. F.; Danauskas, J. X. (Dep. Epidemiol. & Public Health, Sch. Med., Univ. Miami, Miami, FL 33101) **Development and**

application of methodology for determining 1,2-dibromo-3-chloropropane in ambient air. *J. Environ. Sci. Health B* 15(5): 519-528; 1980 (1 reference).

A technique for the detection of hexachlorobenzene in air was modified to detect DBCP at levels of 0.02 ppb. Chromosorb 101 serves as a trapping medium, and eluted DBCP is analyzed by electron capture gas chromatography. In tests using various air flow rates and sampling periods of 0.5-3 hr, recoveries of over 90% were obtained for DBCP levels ranging from 0.07-20 ppm. When DBCP was stored on Chromosorb 101 for 1 mo, over 90% of the compound was recovered. Experiments were performed to assess the potential exposure levels of the suburban population to DBCP applications by the drench method. Measurements of DBCP levels using the present technique showed that re-entry should be delayed at least 1 day in agricultural areas where safety equipment is not routinely worn.

81-2685. Nanda Kumar, N. V.; Udaya Bhaskar, S. (Dep. Zool., Sri Venkateswara Univ., Tirupati 517502, India) **Colorimetric determination of dimethoate by quantification of cholinesterase inhibition.** *J. Food Sci. Technol.* 17(3): 153-155; 1980 (12 references).

A simple, sensitive and rapid colorimetric procedure for the quantification of dimethoate and its oxygen analogue in fortified paddy samples is described. The assay uses pig liver acetone powder as cholinesterase (ChE) enzyme source and color complex is formed by a diazo coupling reaction between 1-naphthol and the diazonium salt, Fast Blue B. The magenta color complex is measured at 540 nm and the amount of 1-naphthyl acetate metabolized is compared to a standard graph. ChE inhibition is detectable at ng levels, and dimethoate concentrations ranging from 50-1000 ng could be measured after oxidation of the insecticide with bromine vapor to its oxygen analogue.

81-2686. Samosvat, L. S.; Likhovidova, T. P.; Kaplin, T. P. (State Inst. Adv. Train. Physicians, Kiev, USSR) **Opredelenie vernama, drepamona, saturna i yalana v oblektakh okruzhayushchei sredy. [Determination of Vernam, Drepamon, Saturn, and Yalan in biological samples.]** *Khim. Sel'sk. Khoz.* 19(4): 53-54; 1981 (4 references) (Russian).

A thin layer chromatographic method is described for determination of the thiocarbamate herbicides Vernam (vernolate), Drepamon (tiocarbazil), Saturn (benthiocarb), and Yalan (molinate) in water, soil, sludge, fish, plants, rice grain, and straw. Identification of herbicides is based on the Rf value (0.6 for Vernam, 0.72 for Drepamon, 0.52 for Saturn, and 0.38 for Yalan) and on the chromatographic spot color. Vernam and Yalan develop as light blue spots. Drepanom and Saturn develop as bright lilac spots. The sensitivity of the method is 0.5 μg/sample.

81-2687. Klisenko, M. A.; Iurgaitene, P. Yu.; Kiseleva, N. I. (All-Union Res. Inst. Hyg. & Toxicol., USSR) **Opredelenie triforina v vozdukhe, vode i pochve. [Triforine determination in air, water, and soil.]** *Khim. Sel'sk. Khoz.* 19(4): 54-54; 1981 (Russian).

A method of determining the fungicide triforine in water, air, and soil is described. The method is based on extraction with chloroform, purification of the extract, and thin layer chromatography. The sensitivity of the method is 10 μg/m³ for air, 0.04 mg/l for water, and 0.08 mg/kg for soil.

81-2688. Farrington, D. S. (Dep. Ind., Lab. Gov. Chem., London SE1 9NQ, England) **Analysis of ethylenethiourea residues in ethylenebisdithiocarbamate fungicides.** *Meded. Fac. Landbouwwet. Rijksuniv. Gent* 44(2): 901-911; 1979 (11 references).

Two high performance liquid chromatography (HPLC) systems and one gas liquid chromatographic (GLC) system are described for the determination of ethylenethiourea (ETU) in ethylenebisdithiocarbamates, (EBDCs). Such analyses are complicated by the presence of other breakdown products, and some separation of ETU must be carried out prior to its determination. For HPLC the optimum mobile phase for elution of ETU from a nitrile column was 65/35 hexane/ethanol. Methanol extracts of technical and formulated EBDCs were analyzed with this system. Methanol extracts of EBDCs were also chromatographed on an ODS column with water as the mobile phase. GLC was possible on a moderately polar column, a 2% Carbowax 20MTPA on Chromosorb WHP, in a column over at 210°C with flame ionization detection. Nineteen samples of technical and formulated maneb, zineb, and mancozeb were analyzed. Mancozeb consistently showed much lower ETU contents than maneb and zineb samples. GLC invariably gave higher figures for ETU content than did the corresponding HPLC analysis. It was concluded that the HPLC analyses gave more accurate results for ETU content of EBDC samples.

81-2689. Ogierman, L. (Inst. Plant Prot., Dep. Anal. & Qual. Control Pestic., PL-44153 Sosnicowice, Poland) **The application of thin-layer and gas chromatography to separation and identification of carbofuran and its metabolites.** *Microchem. J.* 26(2): 140-154; 1981 (10 references).

Conditions of TLC and GLC separation and identification are described for carbofuran and several of its metabolites. Linear correlations are given for the R_M and log t_R coefficient. The additivity of chromatographic coefficients for these compounds might be useful in their qualitative identification when a complete set of standard compounds is not available.

81-2690. Waefler, C.; Glatt, V.; Meier, W. (Kantonales Lab. Zurich, CH-8030 Zurich, Switzerland) **Rasche und einfache Bestimmung der wichtigsten Fungizide auf Salat. [Rapid method for determining most important fungicides in salad.]** *Mitt. Geb. Lebensmittelunters. Hyg.* 72(1): 22-30; 1981 (4 references) (German).

A rapid and reliable method for determining residues of captafol, dichlofluanid, folpet, glycophen (iprodione), quintozene, vinclozolin, dithiocarbamates, and MBC (carbendazim) in lettuce is described. Following extraction with ethyl acetate, the sample, diluted with acetic ester, is injected directly into a gas chromatograph (Hewlett-Packard System 3353A). The recovery rates were 74.8-100.1%. The detection limits were 0.02-0.1 ppm. Fungicide residues were found in 11 of 42 domestic and 56 of 88 imported lettuce samples.

81-2691. Raimann, H. (Bezirks-Hygieneinspektion & Inst. Suhl/Sitz, DDR-5800 Gotha, DDR) **Duennschichtchromatographische Bestimmung von Chlorpropham in Zwiebeln (*Allium cepa* L.) – Ein Beitrag zur Ruckstandsanalytik der Herbizide. [Thin-layer chromatographic determination of chlorpropham in onions (*Allium cepa* L.). A contribution to the analysis of herbicide residues.]** *Nahrung* 25(1): 49-52; 1981 (9 references) (German).

The thin-layer chromatographic determination of chlorpropham in onions is described. Following extraction with chloroform from the homogenized sample, the extract is cleaned up by column chromatography with silver nitrate-containing alumina and by acetonitrile + hexane partition. Alumina plate is used for determination with silver nitrate solution in acetone as spray reagent and toluene/dichloromethane (8 + 2) as solvent system. Chlorpropham residues can be detected from a lower limit of 0.05 mg/kg, and can be determined by visual semiquantitative comparison of the spots from 0.1 mg/kg upward. The lower detection limit on the TLC plate is 0.1 μg. The average recovery rate is 87%.

81-2692. Nishiyama, K.; Usitani, S. (Sch. Public Health, Fac. Med., Hirosaki Univ., Hirosaki, Aomori, Japan) **[Examination of the methods for determining the concentration of pesticidal dust in inhaled air.]** *Nippon Eiseigaku Zasshi (Jpn. J. Hyg.)* 36(1): 444; 1981 (1 reference) (Japanese).

A method for determining the concentration of pesticide dust in inhaled air was studied using 3% phosmet dust and fenitrothion emulsive concentrate diluted 500-fold. At first, the air containing the dust was suctioned through a holder provided with a filter pad and a millipore glass filter; collecting efficiency was measured by the amount of dust collected on the filter pad and the amount of dust to pass through the millipore filter. Results obtained by the conventional impinger method were compared with results obtained by pad method. Using a commercial dust-prevention mask provided with a filter pad, the concentration of the aerial dust was determined. A high dust-collection efficiency was obtained: 30 l/min dust on the filter pad and 5.5 mg dust on the millipore glass filter, corresponding to aerial concentrations of 2.083 mg/m³ and 0.005 mg/m³, respectively (collecting efficiency 99.8%). Results were similar to those obtained by the conventional method of using impinger. In determining aerial mist of diluted emulsion concentrate, results were similar.

81-2693. Cave, S. J. (ICLS Lab. Ltd, Birmingham B7 4DW, England) **Simultaneous estimation of bioresmethrin and piperonyl butoxide by gas-liquid chromatography with chemical-ionisation mass spectrometry.** *Pestic. Sci.* 12(2): 156-160; 1981 (2 references).

An analysis method for the simultaneous determination of bioresmethrin and piperonyl butoxide is presented. The detection limits of the method are 0.2 ng for bioresmethrin and 2 ng for piperonyl butoxide. Recovery rates for extraction of bioresmethrin and piperonyl butoxide from samples are 96 and 94%, respectively. The method was tested on laboratory-fortified wheat samples. A formulation containing bioresmethrin (4.8% by wt), piperonyl butoxide (48.0%), emulsifiers (10.0%) and aromatic solvents (37.2%) was diluted with water and sprayed on stored wheat in three 3-kg batches. The nominal concentration of bioresmethrin in each batch was 2, 1, and 0.2 mg/kg. Hexane was added to the treated wheat and allowed to stand overnight in the dark at room temperature. Hexane was decanted and the wheat washed with 2 additional amounts of hexane. All extractions were carried out within 4 days of spraying the wheat. Standard solutions and concentrated extracts were analyzed in triplicate by GLC. The mass spectrometer was set to observe ions at *m/e* 171 for bioresmethrin and at *m/e* 177 for piperonyl butoxide. Bioresmethrin and piperonyl butoxide eluted from the OV101 column simultaneously in about 2.5 min. No interference from compounds used in the formulation or extracted from the wheat was noted. It is concluded that this simple extraction, followed by analysis by mass fragmentography, is a quick and specific method for studying the depletion of bioresmethrin and piperonyl butoxide in treated whole grain during storage.

81-2694. Ellgehausen, H. (Ciba-Geigy Ltd., Agric. Div., Basle, Switzerland) **Reversed-phase chromatography as a general method for determining octan-1-ol/water partition coefficients.** *Pestic. Sci.* 12(2): 219-227; 1981 (27 references).

The usefulness of octan-1-ol/water partition coefficients in predicting soil absorption, mobility in soil, bioaccumulation by aquatic organisms, and food-chain transfer of non-ionic organic pesticides prompted this study of partition coefficient determination. The octan-1-

ol/water partition coefficients for 20 non-ionic organic chemicals were determined using reversed-phase high-pressure liquid chromatography (HPLC) and thin-layer chromatography (TLC) on commercially available, reversed stationary phases. The pesticides analyzed were monuron, thiazafluron, metalaxyl, atrazine, metolachlor, terbutryne, fluorodifen, fenuron, metoxuron, diuron, isazophos (Iral), profenofos, ronnel, *p,p'*-DDT, and profluralin. The study demonstrated that when the solubilities of a substance in both water and octan-1-ol are known, the partition coefficients can be accurately calculated. An octan-1-ol/water partition coefficient estimated on the basis of aqueous solubility alone can be misleading. When no solubility data are available, the best method is suggested to be reversed-phase TLC, an inexpensive method that does not require complicated and expensive instruments. However, it cannot be used for volatile compounds or unstable compounds, because 1-2 hr are required. The best method is HPLC on reversed-phase stationary phases. Impurities do not affect the result, no pretreatment of the column or mobile phase is needed, and the determination requires < 10 min/sample.

81-2695. Tannock, J.; Wessels, C. L. (Dep. Res. & Spec. Serv., Salisbury, Zimbabwe) **Determination of carbofuran residues and metabolites in plant material.** *Pestic. Sci.* 12(2): 228-234; 1981 (27 references).

An improved method for the analysis of carbofuran residues and metabolites in plant material has been developed that eliminates unnecessary procedures without losing sensitivity. The method calls for separate extraction of bound and non-bound residues followed by clean-up by coagulation, preparation of a derivative with 1-fluoro-2,4-dinitrobenzene, and gas liquid chromatography using a thermionic nitrogen-selective detector system. The method can be used for general screening of carbamates as well as for analysis of specific carbamate pesticide residues. The new method was tested on field-treated cabbages. The amounts of carbofuran residues detected by this method were invariably higher than those reported from other methods in both field-treated and laboratory-treated cabbages.

81-2696. Baker, P. G.; Hoodless, R. A.; Tyler, J. F. C. (Dep. Ind., Lab. Gov. Chem., London SE1 9NQ, England) **A review of methods for the determination of polychlorodibenzo- *p*-dioxins and polychlorodibenzofurans in phenoxyalkanoic acid herbicides.** *Pestic. Sci.* 12(3): 297-304; 1981 (41 references).

A review is presented of the analytical methods for the detection and determination of polychlorodibenzo-*p*-dioxins and polychlorodibenzofurans in phenoxyalkanoic acid herbicides. Limits of detection ranged from 0.001 to 0.05 mg/kg for TCDD. Possible interferences in analytical procedures and losses of PCDDs during analysis are discussed. The limits of detection for PCDDs and PCDFs were generally lower for environmental samples than for herbicide formulations. Samples contained lower % mineral oil, and were therefore easier to clean up; larger samples could also be taken. Capillary column gas liquid chromatography coupled with high resolution mass spectrometry was concluded to be the most desirable method for identification of PCDDs. (Author abstract by permission, modified)

81-2697. Hunter, K.; Lindsay, D. (Dep. Agric. Fish. Scotland, Agric. Sci. Serv., East Craigs, Edinburgh EH12 8NJ, Scotland) **High-pressure liquid chromatographic determination of *sec*-butylamine residues in potatoes.** *Pestic. Sci.* 12(3): 319-324; 1981 (13 references).

Fluorescamine, 4-phenylspiro[furan-2(3H),1'(3'H)-isobenzofuran]-3,3'-dione, derivatives of primary aliphatic amines were separated by high-pressure liquid chromatography using a reverse-phase system with fluorescence detection. This technique was applied to the determination of residues of the fungicide *sec*-butylamine in potato tubers; the limit of detection was 0.36 pmol, equivalent to a residue of 0.1 mg/kg in potato samples. A second amine, phenethylamine, was identified in extracts from artificially rotted potato flesh but this did not interfere with the analysis of *sec*-butylamine residues. (Author abstract by permission)

81-2698. Van Haver, W. (Inst. Hyg. Epidemiol., B-1050 Brussels, Belgium) **Determination of carbendazim and thiophanate-methyl residues in some vegetables and fruits by high pressure liquid chromatography.** *Z. Lebensm. Unters. Forsch.* 172(1): 1-3; 1981 (6 references).

A simple method is described for the quantitative determination of carbendazim and thiophanate-methyl in fruits and vegetables. The sample is extracted with methanol and the extract is purified on a C18-Sep-pak cartidge. The cleaned-up extract is ready for injection into a liquid chromatograph. For some vegetables, and to insure a longer column life, a further cleanup of the extract on a basic aluminium oxide column is recommended. Ten samples can be analyzed in about 3 hr. Recoveries are very good (90-100%). Sample results are given for tomatoes, beans, lettuce, chicory, and strawberries.

81-2699. Osikina, V. N. (Res. Inst. Ind. Hyg. & Occup. Dis., Kiev, USSR) **Opredelenie gistemnogo fungitsida benatsila v vozdukhe tonkosloinoi kromatografiei na silkikagele. [Determination of systemic fungicide benacyl using thin-layer chromatography on silica gel.]** *Zh. Anal. Khim.* 34: 1653-1655; 1979 (4 references) (Russian).

A quantitative determination method for the systemic fungicide benacyl (1-phenoxyacetyl-2-carbometh-

oxyaminobenzimidazol) in air is described. Air samples containing benacyl vapors were withdrawn at rates of 0.2, 0.5 or 1 l/min through the absorbent and the samples were subjected to thin layer chromatography on silica gel. A spot with R_f of 0.75 corresponded to benacyl. Due to rapid benacyl degradation, the samples should be analyzed not later than 2 days after withdrawal. The sensitivity of the method is 1 μg/sample.

81-2700. Chalaya, Z. I.; Gorbonos, T. V. (Author address not given) **Opredelenie klorpropionovykh kislot i ikh sodei v vode metodom tonkosloinoi khromatografii.** [Determination of chloropropionic acids and their salts in water by thin layer chromatography.] *Zh. Anal. Khim.* 35(7): 1352-1354; 1980 (9 references).

Thin-layer chromatographic determination of chloropropionic acids (CPA) and their salts (including the herbicide dalapon) in water is described. Butylacetate:-acetone (2:1) system provided effective separation of di-, mono- and tri-CPA. The R_f values were 0.42, 0.72 and 0.22, respectively. The sensitivity of the method was 0.07, 0.1 and 0.08 μg. Maximum extraction of CPA was achieved by butylacetate.

See also 81-2401, 81-2408, 81-2437, 81-2442, 81-2455, 81-2467, 81-2485, 81-2494 *and* 81-2582.

PESTICIDES ABSTRACTS

QUARTERLY INDEX

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PREFACE

The basic design for this index was supplied by the Management Support Division, Office of Pesticides and Toxic Substances, Environmental Protection Agency. It consists of two subject indexes (concept and compound) and two author indexes (personal and corporate). Primary and secondary headings in the Concept Index appear as subordinate headings in the Compound Index, both indexes having three levels of specificity.

In the Concept Index, only general aspects are indexed under the broader terms shown below. For specific terms, the reader should consult the appropriate heading in the Concept Index, selecting the narrower term that best fits his need.

Compounds are indexed by their common names; where other designations are used by authors, these synonyms appear with the notation to *see* the common name. Articles referring, in general, to structural or functional chemical classes are indexed under the broader headings (e.g., organochlorines, herbicides, etc.).

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